The FOUNDRY

Volume 52
Number 19

Published
Semimonthly

CLEVELAND, OHIO, OCTOBER 1, 1924

Meeting the New Competition

Era of Specialization with Excess Plant Capacity Brings Foundrymen Face to Face with New Conditions

FOUNDRYMEN are confronted by new complexities in the battle for business. The war and the period immediately following brought about a tremendous expansion in castings manufacturing capacity, which during the past three or four years has not been fully engaged. Further, the encroachment of stampings, forgings and other products has been noted in many lines, while competition within the ranks has become more intense.

Doubtless these conditions will bring about the industrial decease of a number of shops, but the fatalities can be immeasurably reduced by the application of sound business judgment and the teachings of experience.

A lesson may be drawn from the malleable castings branch of the industry. A little more than 10 years ago, malleable castings were subjected to a cross fire of competition for which lack of uniformity, comparatively low strength and lack of toughness furnished ammunition. At that time the American Malleable Castings association began a systematic campaign for improvement among its own members. It established definite standards for tensile strength and percentage of elongation under stress. It supervised the foundry practice of member plants, provided for periodical tests of castings and thorough inspection. A system of certification practically guaranteed to the buyer a standard quality.

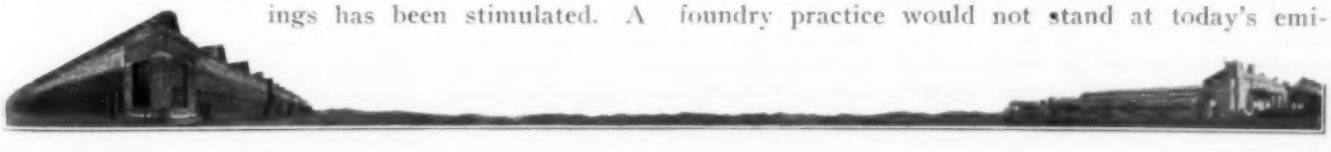
The result has been of benefit in raising the standards both of practice and product. Nor have members alone benefited, for as a result of the improvement in quality, the demand for malleable castings has been stimulated. A systematic campaign of education through advertising immeasurably has increased this benefit to the entire malleable industry.

Similarly, several years ago, a number of manufacturers of small and medium steel castings associated themselves under an organization known as the Electric Steel Founders' Research Group. They placed the supervision of their practice and the inspection of their product under a competent director and gave him authority to act. The result has been an improvement in quality, increased faith on the part of the buyer, and stabilized demand. During the recent summer, members of this group have been fortunate in maintaining a high rate of operation in the face of a general depression.

These examples well might serve to guide others and more particularly gray iron jobbing foundries, where irregularities in quality price cutting and the pressure of competition from rolled and other cast metals have brought about a condition of extreme peril.

The remedy is not to be found in quoting lower price than the competing manufacturer, particularly if costs are hazy or are entirely disregarded. Foundries have a right to expect a fair profit, and they cannot stay in business unless they obtain it.

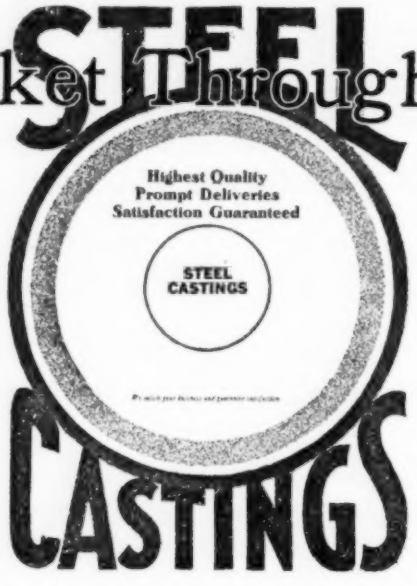
Since its inception THE FOUNDRY has sought to place before its readers the best ideas on the technical and business phases of castings manufacture. Its facilities have grown in step with the march of foundry progress. It has brought about an interchange of experience without which American foundry practice would not stand at today's emi-



nence, for after all experience is the only reliable guide.

With this thought in view, the following short examples of how others have improved their practice, accelerated output, cut down overhead or in some other have advanced themselves in the face of keen competition will serve as suggestions. All are not applicable to any one plant nor can all foundrymen find in any single instance suggestions for their own guidance. They are compiled from actual conditions encountered by the editors of THE FOUNDRY, at various times and in several plants, but in fairness to the principals concerned, no individual names are given.

Created Market Through Advertising



REMEMBER the mouse trap statement attributed to one of the greatest of American literary philosophers? That coupled with the statement immortalized by the manufacturers of a well known baby food "we are advertised by our loving friends" doubtless has served to keep many a foundry light successfully hidden under the bushel of buyer's indifference.

Consider now an exception. A steel foundry in the East, which once possessed a strategic situation, close to growing industrial centers, found itself losing customers. Probably it was not entirely to blame for the larger industries of the section had, through amalgamation or dry rot closed their doors, one by one. Old time conservatism had rule in marketing methods, although the production end kept well abreast of the times especially during the war, through the influence of a competent superintendent.

Perhaps this superintendent was endowed with more than his ordinary share of business acumen, together with the knowledge of foundry practice. At any rate, when business came to such a pass that the foundry confronted the thorny path with a receiver at the end of it this executive enlisted financial backing and the active co-operation of a few business men of the city to take complete control of the plant.

He knew the capacity of the shop both as regards character and quantity of product. He also was familiar with the cost factors of his business and realized the handicap imposed by shipping rates to more remote points of consumption.

The upward sweep of buying which followed the war found him with a plant on his hands, a competent staff of men, considerable stock of raw material, but few orders. He set up a sales organization which might have been looked upon with condecension by many of the larger foundries of the country, but which for effectiveness was unique for a small plant. He put one man on the road on commission, sending him into the larger automobile centers, the steel producing regions and the prosperous middle western machinery districts. This salesman had been schooled on costs within the shop, was paid on a commission and drawing account basis, and was limited to quotations which would yield at least a certain minimum price over costs. A careful series of advertisements, emphasizing deliveries as promised and specification steel castings was prepared and inserted in a number of publications that for their business and price information are read by executives and purchasing agents. Large tonnage jobs were not solicited, but the regular, small-time, repeat orders were cultivated carefully with the result that a diversified demand was created. Fortunately, the shop, could back up all claims as to quality and delivery and in consequence secured a steady clientele of customers.

When the depression of 1921 hit the country, this shop, athough far removed from its source of demand fared exceptionally well. The diversification of its product prevented the severe shock which many encountered that had confined their output to large tonnage requirements. Further, when some of the larger plants confronted by mounting overhead charges due to decreased operating rates closed temporarily, this small eastern foundry inherited a considerable amount of business, which its advertising brought to its doors. It had demonstrated its ability to make first class mouse traps, but had not hesitated to tell the world.

Production Is Trebled

AFTER building up a business to the apparent capacity of its plant, a company engaged in the manufacture of small castings was confronted with the alternative of turning down additional orders or of erecting additional buildings. The increase in business as represented by the additional orders was due almost entirely to the reputation the firm had established for the excellent character of its product. Besides the capital expenditure involved in the construction of any proposed addition to the plant, the time feature also exerted considerable influence on the councils leading to a final decision.

At the time the problem was presented for consideration, a single cupola lined to 76 inches was capable of melting the entire heat of 40 tons in a little over 2 hours in the afternoon. The castings were all extremely light and the floor of molds produced from each molding machine covered a large area. The management argued, quite logically, that if some method could be adopted whereby the floor might be covered several times a day instead of only once, production might be increased to a grat-

ifying degree. Several methods, including stacking the molds, were considered, but none of the methods seemed to synchonise properly with the melting schedule until a suggestion was offered to the effect that the molding and melting operation be carried on continuously throughout the day.

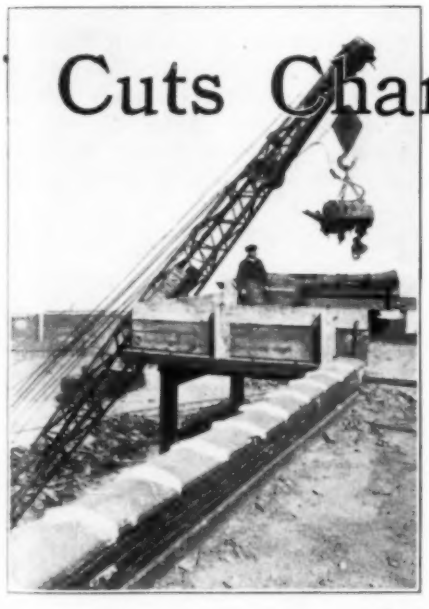
Under former conditions the molders ceased producing molds the instant the iron commenced to run from the cupola. The remainder of the day was spent in pouring the molds and shaking them out. This feature presented a promising field and further investigation seemed to indicate that the more sensible method would be to keep the skilled men molding and to delegate the pouring and shaking out to other men without these special qualifications.

The number of molding machines was increased from 36 to 72 and they were rearranged in a double row back to back down the center of the shop. Instead of filling a long floor as formerly, each molder only filled half a floor, but he filled it twice a day. To be strictly accurate, the floor never actually was covered with molds at any one time. Iron was supplied continuously all day and the floors were poured in rotation from a gangway on either side of the building. Occasionally a floor became nearly filled with molds before it was poured, but usually the molds on any given floor were poured and shaken out before more than half of the space was covered.

A second cupola lined to 52 inches, with a melting capacity of 10 tons per hour was installed and the original cupola was lined down to the same diameter. The cupolas were operated on alternate days to provide opportunity for relining and repairs. Under normal conditions, the iron ran from the spout continuously and was taken away in several 1000-pound bull ladles mounted on electric trucks. A tilting spout at right angles to and in front of the main spout enabled the driver of one truck to spot his ladle to the right before a second driver withdrew his ladle from under the left of the same spout.

The ladles, as before stated, served each floor in rotation. The metal was poured into hand ladles and distributed among the molds by a gang specially delegated for the purpose. The men who poured the molds also shook out the castings, loaded them on trucks and cut over the sand.

Cuts Charging Costs



FOR several years the coke and iron for a 60-inch cupola melting 30 tons a day were wheeled on barrows from the stock piles in the yard to the elevator. The elevator conveyed the barrows to the charging floor where the material was dumped indiscriminately. Later the coke was forked into the cupola directly from the pile, but the iron was lifted piece by piece and piled on a scale until the beam indicated the correct amount for a charge. The iron then was again lifted by hand, piece by piece, carried from the scale to the charging door and thrown into the cupola. Four men were required in the yard and three were needed on the charging deck. A congested condition prevailed at all times, the men apparently were extending themselves to the limit, but the metal was melted satisfactorily and in sufficient quantity to pour all the castings on the floor and so long as this continued the management paid no particular attention to the question of handling and charging cost of the iron. Like many other changes in foundry practice a sudden jolt from an unexpected quarter was responsible in this case for the adoption of vastly improved methods. The demand for castings practically was doubled, involving a heat of over 50 tons a day. The demand not only was met successfully, but the number of men employed actually was reduced.

The charging floor was extended beyond the building to receive material from the yard swung up by the long boom on a derrick or yard locomotive crane. Pig iron and scrap were lifted by a magnet and dropped on the platform. Coke was forked by hand into the large barrow formerly used and lifted by a special sling attached to the hook on the end of the boom. Occasionally a barrow full of coke was taken up on the elevator which was kept in commission in case of an emergency arising, or in the event that the derrick for any reason might be incapacitated for a period.

Two men, one on the hoist and the other engaged in miscellaneous duties, swung twice as much iron up on the platform, as had formerly been wheeled up by four men equipped with wheelbarrows. The derrick also lifted the greater part of the coke required and for a certain period each day operated a drop ball for breaking the scrap.

Three men were retained on the charging deck, but they charged almost twice as much iron and coke as formerly and in addition they helped the cupola tender by removing the *drop* in the morning, by assisting him in preparing the sand bed and in procuring the shavings and kindling wood for the coke bed.

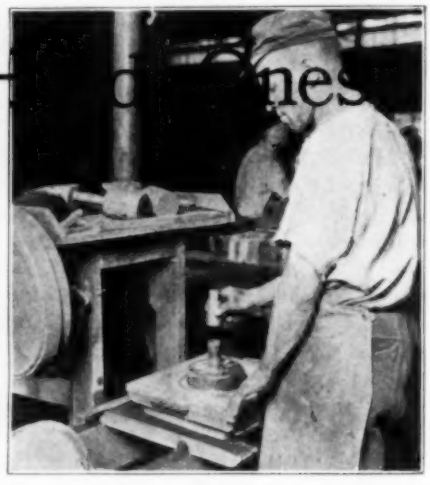
A space 10 x 10 feet was cut in the charging floor immediately in front of the cupola door and remounted as a scale platform. This platform had a holding capacity of between 30,000 and 40,000 pounds and was filled in the afternoon before the time arrived to charge the cupola. The men loaded their barrows at the point where the material was dropped by the derrick, they wheeled the iron to the scale and dumped it in a miscellaneous pile. Just before charging the cupola, the amount of iron on the scale was weighed. Then the indicator on the scale arm was set back 5000 pounds, the weight of one charge. The men picked the iron from the pile and threw it into the cupola until the scale beam lifted. The indicator then was set back an additional 5000 pounds and the performance was repeated until the pile was exhausted. The cupola had a holding capacity of seven charges, 35,000 pounds up to the charging door before the blower was started.

The time usually elapsing between the time the cupola was filled and the time the charge commenced to settle provided an opportunity to replenish the pile of iron on the scale to a considerable extent. Afterward the men piled sufficient iron on the scale for three or four charges at a time until the entire amount for the day was charged into the cupola. The method might be improved and probably will be eventually.

For example instead of providing a scale in front of the cupola the scale might be incorporated in the platform designed to receive the iron from the

derrick in the yard. The idea might be still further elaborated by providing two landing platforms with a scale in each. Thus while the men were wheeling the iron away from one platform scale to the cupola, the derrick man might be filling the second platform with iron from the yard. Under special conditions the platforms might be filled at night, thus releasing the derrick if necessary for other duties during the day.

Picks the H[illegible]nes



AN INTERESTING example of how modern competitive conditions in the foundry business were met is presented in the case of a young executive who built and manages a foundry in one of the principal foundry centers in the Middle West. It serves to illustrate anew the value and importance of several fundamental factors essential to the success of any business. The first is the necessity of an absolute and intimate knowledge of the business, not only in its broader aspects, but also in the ramifications of its various details.

The second is a keen interest in the business, the same kind of interest usually devoted to a hobby. The third is a feeling of honest and legitimate pride in doing a good job well. The fourth and perhaps the most important of all is the capacity for hard work which involves the posession of that well known combination, a sound mind in a sound body.

Instances are on record to show where an indomitable will has carried a man to success over the limitations imposed by an indifferent physical condition, but such instances are rare and may be regarded merely as the exception to an almost universal rule. This is not meant to imply that a man must be a Hercules, but a body functioning normally is essential to a normal mind, a mind which travels along common sense lines.

While going to technical high school this young man decided to become a foundryman. From what he had seen in the school foundry he was satisfied that the work presented many fascinating features. The processes involved in the production of castings appealed to him in a particular manner and he felt that the field presented in the casting industry was so wide he never need anticipate his interest growing stale. In his estimation the profession of founding in metals deserved as earnest study and offered as many rewards and advantages as any other profession. With this idea in mind he laid out a program of work and study and followed it diligently for a period of several years, or until he felt qualified to enter business on his own account in his own foundry.

After graduating from high school he served an apprenticeship of four years in a foundry specializing in heavy machine castings. Then he spent 2 years in a pattern shop, followed by 2 years as a journeyman molder in several shops in the same city. In the meantime he studied bookkeeping and accounting in night school, besides mentally devouring all the foundry literature that came within his reach. Then he organized a company, erected and equipped a foundry with a capacity of 25 tons a day and proceeded to secure orders for castings in a manner a little out of the ordinary.

He recruited his workmen from the most skilled molders in the city by offering them stock on easy terms in addition to their wages. He gambled on his ability to make a success of the venture and his men met him half way. With faith in his own ability and in the qualifications of his men he confined his solicitation for orders to varous lines of castings usually listed as hazardous, castings that many foundries are inclined to side step. By guaranteeing delivery dates and by almost invariably meeting these dates he attracted favorable attention and gradually many orders came unsolicited.

Considerable opposition was shown at first when he quoted a higher price than his competitors, but this opposition on the part of the customers gradually disappeared when they found that they got what they wanted when they wanted it. In many cases the prompt delivery of an important casting at a comparatively high price more than offset the saving promised by placing the order elsewhere at a lower price, but with the risk of delayed delivery.

Confidence in himself and his organization prompted him to solicit orders for castings on a modern business basis where a premium is expected and paid for outstanding features including insurance and service. Instead of depending on excuses and alibis to carry him over broken promises, he guarantees to deliver the goods and charges a reasonal fee for the service.

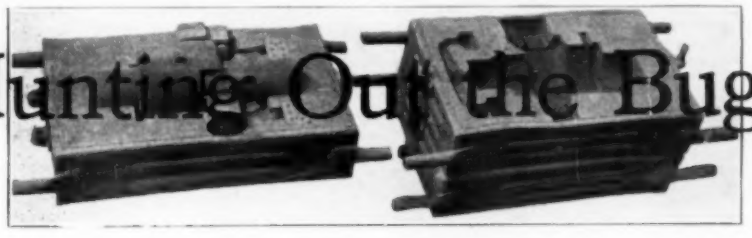
Makes Parts for Stock

THE three most important items to be considered in foundry cost keeping are *raw material, labor* and *overhead*. The first two items figure out approximately the same with foundries located in the same district. The overhead depends upon the individual conditions and in most instances is governed by equipment, location, etc. If overhead is watched carefully it will enable a foundryman to meet keen competition which is prevalent at the present time.

A number of jobbing foundries are heavily burdened with overhead expense which they are compelled to carry. This places them at a great disadvantage in submitting bids for future work. It is obvious that when a foundry is running part capacity with a low tonnage, the overhead runs high materially adding to the cost of production. Certain figures cannot be changed as for example insurance. Other charges such as non-productive labor, light and heat may be modified slightly. To interfere radically with non-productive labor or other factors of the organization, has a tendency to lower efficiency and this in itself can seriously hamper production.

It is natural to assume that foundry-

men often have put this question to themselves during these lean times—"How can I cut overhead expense to place a lower figure on my work and meet keen competition and yet not lower standards?" One foundryman answered this question in a satisfactory manner by bidding on a large quantity of standardized work which in this instance was wash boiler handles, dampers, door hinges, and some standard step plates or grates. This foundry was running half capacity on general machine parts, which was the usual line of work handled. It was found that a number of light molding machines were idle and plenty of vacant floor space was available to handle this standardized work. His bid was such as to leave him only a narrow margin of profit, so low in fact as to be considered poor business. However, this figure took care of a certain percentage of overhead expense which enabled him to meet competition on his regular line of work allowing him a fair margin of profit. It enabled him to retain his organization, and do a larger volume of business with a balance on the right side of the ledger. Further, the fill-in work became later a source of profit.



Hunting Out the Bugs

AN INHERITED tendency to destroy things which consciously or unconsciously influences the minds and actions of men connected with naval or military forces, probably was responsible for the tactics adopted at one of the United States navy yards before attempting to manufacture a certain engine cylinder on a production basis. Former experience had indicated that many castings of this kind fail in service although apparently satisfactory in every particular when machined and assembled in place. Severe local strains to which the cylinders are subjected serve to expose any defects in the casting. Sometimes the castings fail in service from some obscure cause and many succeeding castings are made before a remedy finally is discovered and applied. A preventive measure, designed to eliminate long and costly experiment later, was adopted when the manufacture of the first of a lot of engines was undertaken in the navy yard foundry.

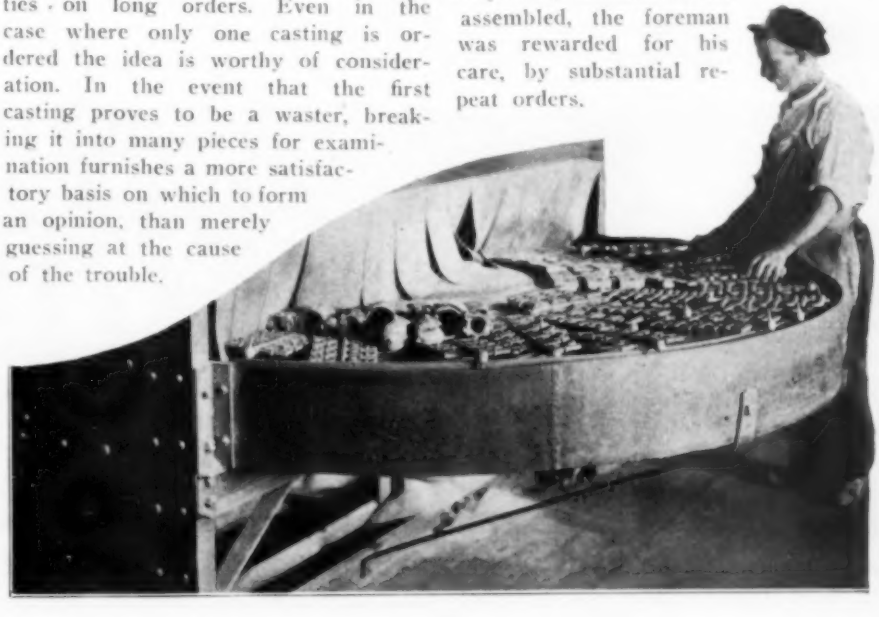
Extreme care was exercised in molding the first casting. The patterns and coreboxes were checked in every detail for accuracy in conforming to the design. The various cores were placed and anchored with the greatest precision to insure the desired thickness of metal between the various members. Every reasonable care, based on general experience, was exercised to forestall the usual hazards incident to molding and pouring a casting of this character. After the casting was made and shaken out, it was deliberately broken into many small pieces so that the structure might be examined carefully for defects.

Spongy spots were discovered in several places, areas that inevitably would yield under pressure and develop leaks. Before attempting a second casting, the contour of the pattern and some of the coreboxes was changed wherever possible to produce a more even distribution of the metal. Chills were prepared and when the second mold was made, these chills were introduced at the places where calculation indicated they were required. The second casting was completely machined and tested before it was broken into many pieces for a thorough examination. As a result of this investigation, a few additional minor changes were made in the molding method. The third casting was perfect and as a result the entire order of 300 castings was turned out without a waster. The foregoing method may not be applicable where only one or two castings are ordered, but it presents interesting possibilities on long orders. Even in the case where only one casting is ordered the idea is worthy of consideration. In the event that the first casting proves to be a waster, breaking it into many pieces for examination furnishes a more satisfactory basis on which to form an opinion, than merely guessing at the cause of the trouble.

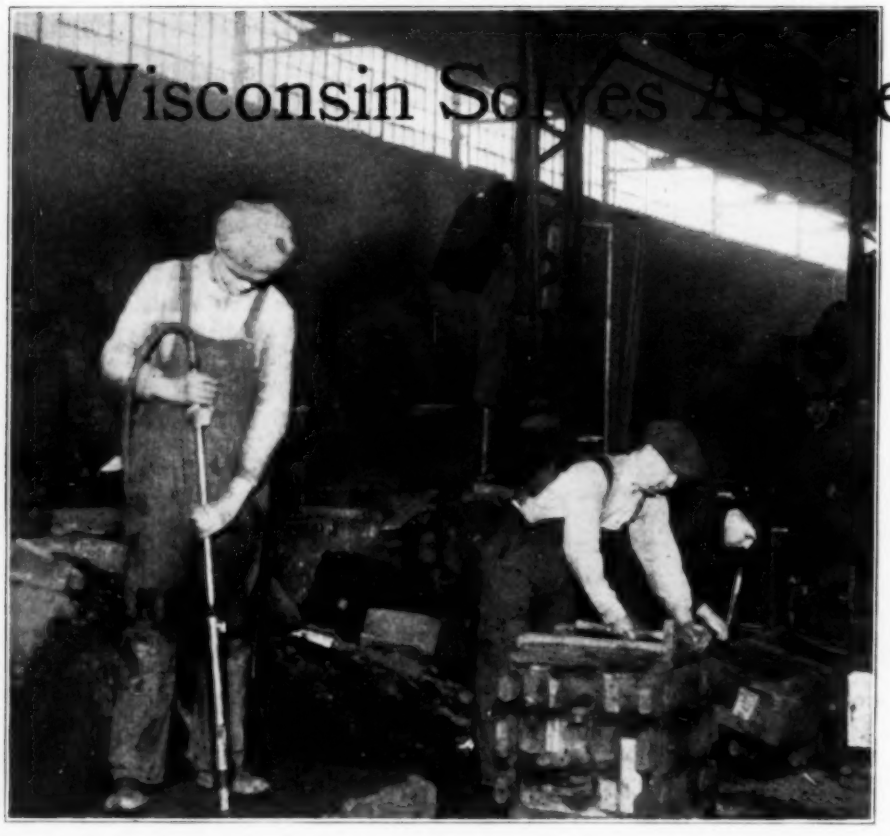
Improvement in Finish Builds Market

A large western manufacturing company that had been seriously embarrassed financially by unfavorable business conditions in its special line of work, decided to close down the foundry and buy the few castings required *outside*, and thus eliminate in a great degree their burdensome overhead expense. After studying conditions from the company's angle, the decision seemed sound. The foundry foreman reasoned otherwise. Why not keep the foundry in operation by obtaining *outside* work from plants that were similarly situated to his own and run his foundry if only on a slight margin of profit. Why be the goat in this matter? With a firm belief in his own ability to handle miscellaneous work, he obtained permission to try it.

He went out into the jobbing field and after considerable effort obtained a trial order for a few intricate castings. These castings were made with the usual care and cleaned in the usual manner in the tumblers. On inspecting the castings prior to shipment, the foundryman decided to give them a finishing touch by sand blasting them although this manipulation would be an extra expense, which owing to the close figuring on the work, he could ill afford to assume. When the castings were delivered to the purchaser, they arrived at approximately the same time as castings of a similar nature were received from other foundries. The sand blasted castings were conspicuous by comparison with those made at other foundries. They were of a silvery gray color, true to pattern, smooth, and pleasing to the eye. After these different consignments had been inspected, machined and assembled, the foreman was rewarded for his care, by substantial repeat orders.



Wisconsin Solves Apprentice Puzzle



FOR the past 20 years foundrymen have held meetings to discuss apprentice training. At any rate, this was the subject assigned at certain gatherings, but strange to relate the topic and the discussion were at variance. Really, these meetings more often were lodges of sorrow, where condolences and laments predominated.

This employer bemoaned the lack of interest shown by the younger generation. He deplored encroachment of the more attractive white collar jobs. He deprecated the modern tendency to shirk the onerous duties of foundry life.

Another rose to remark that his shop was on production work. It would be impossible, said he, to give the time necessary to instructing a lot of kids. Further, he was completely equipped with all kinds of machinery, so that he really would need no apprentices, but he would like to know where he could find a few really good, old-time molders to hold down some foremen jobs.

A third assailed our public schools, particularly those manual training centers, which operate foundries for student instruction. Here was he, a taxpayer, assessed to support a foundry at the local high school and not a gosh-dinged boy would come and take a job at his foundry to learn to be a molder. No sir, even his own son drove a grocery wagon in the summer and was going to be a salesman.

Strange to say, those who gathered at the wailing place struck upon three important truths with relation to apprentice training as applied to the foundry industry. Too often apprentice training has served to bring out the seamy side and to disguise the really attractive features of the foundry. The inspiration of capable instruction has been absent. The inherent love for creative work has been blunted by contact with dissatisfied, disillustioned molders with the relation of veteran and neophyte too strongly emphasized,

Is the second opinion justified? Are we at the cross roads, where we turn from Adams curse of labor to the millenium where it is required only to punch a button or turn a switch. Consider the modern automobile production plant, where the individual who has acquired proficiency in tightening seven fender bolts is a craftsman of mark. True, machinery does much, but what of the great multitude of skilled workmen who made the machines themselves. What of that other vast assembly of repair men who keep the old bus running after it has been turned out, machine made, a shining, glistening beauty at the purchasers front door. No, Mr. Production Man, the day when we can do without skilled workmen is not yet. You voiced the fundamental need in your plant for trained foremen.

The public manual training school, the trade school and the technical college do not make trained molders, patternmakers, nor all around foundrymen. As has been pointed by educators who head these institutions, only a trickle, a mere trace of the emanation from these institutions ever finds its way into the broad stream of journeymen.

After all, what has all this to do

AN ENTIRELY VOLUNTARY ORGANIZATION OF APPRENTICES AT THE FALK PLANT IS AN INDICATION OF THE SPIRIT OF THOSE ENGAGED IN TRAINING

with the title which heads this article?

Merely that Wisconsin seems to have found the answer to the apprentice problem. The state, its industrial leaders, its educators and its great army of workmen have evolved a plan successful over a number of years trial, and its highest example of effectiveness may be found in Milwaukee.

MILWAUKEE IS JUSTLY PROUD OF ITS VOCATIONAL SCHOOL, A SPLENDID ESTABLISHMENT WITH COMPETENT INSTRUCTIONAL FORCE AND HEADED BY R. L. COOLEY

Foundrymen attending the American Foundrymen's association convention in Milwaukee during October, have an unusual opportunity to observe the workings of a plan which is meeting a vital need. That the plan is successful is attested by the great number of young men and boys who are taking foundry, patternmaking and related apprenticeship courses. Further, employers are enthusiastic in their co-operation, and the benefits to the public are shown in many ways which will be enumerated. A brief review of the development of the Wisconsin apprentice idea will assist in undertsanding the plan.

In 1909 the state legislature passed a law providing that no person under 18 years of age shall be employed unless ½ day each week is spent in some school. Further, an employer may not employ an apprentice unless a contract, approved by the industrial commission of the state, is entered into by the employer and the minor employe. This contract provides specifically for shop training and a period of ½ day each week to be spent in school. The theoretical and practical training necessary for proficiency thus are combined and clearly specified.

The law decreed that each city of over 5000 population within the state must, and each city of less population may, provide a vocational or continuation school where training in the trades shall be offered. A board of education was provided, separate and distinct from the regularly established school system and made up of two employers, two employes and the city superintendent of schools. Revenue is found under a separate tax levy which at present is 1½ mills on the assessed valuation of each city. Additional state and federal funds also are made available.

Milwaukee was singularly fortunate in having a man of sufficient breadth of vision to take hold of the opportunity offered, and all have profited. Robert Lawrence Cooley was made director of the vocational school for the city. Equipped with a desk, a chair and a then unpopular law, Mr. Cooley set to work to build the Milwaukee Vocational school. Today, he heads an institution valued at $3,250,000 with 172 instructors offering information and inspiration to over 24,000 students during the year. All this has been done within the finances provided by the law, without recourse to additional facilities offered by incurring bonded indebtedness. The apprentices in practically all cases are enthusiastic and happy in their work, and are earning while learning. Employers are giving whole hearted co-operation. The public is profiting.

Perhaps the fundamental reason for the success of the plan is the fact that the apprentices *are* earning while learning. Past experience has shown that the full time trades school does not

Service Recognized

*"ROBERT LAWRENCE COOLEY has brought fresh vision and a new technique into the training of productive citizens. * * * The burdens of complexity make for an artificial civilization that may end in sterile forms; but we hope that out of these experiments will come vision, character and persistence such as will enable society to save itself. * * * His vocational and continuation school has no rival in existence as to size and completeness. It is a model for the country and the world. He fostered its small beginnings and he has guided it to strength and vigor * * * an important contribution to the task of concious social progress."*

These excerpts from an address at the presentation of the degree of master of arts by the University of Wisconsin in June, 1923, serve to indicate the tremendous esteem in which Mr. Cooley is held by those who know his work. He is a lifelong resident of Wisconsin, was educated as a teacher and rose in that profession to hold various executive positions. When the vocational schools were made possible by the Wisconsin law of 1911, Mr. Cooley was chosen by the Milwaukee board of industrial education to head the first school. He has brought that institution to the commanding position which it holds today.

give to industry the trained men which it needs. Those boys and girls who enter trade schools are not productive units in the community while being trained. They earn nothing. Their training costs their parents or the state an amount ranging up to $1000 a year. When they finish their training period, it has been shown that in only a few cases do they enter the line of work for which they are trained. If they study plumbing they do not become journeymen plumbers, but emerge into sales work or perhaps some entirely unrelated line.

Those who complete the apprentice training offered in Milwaukee cost infinitely less during their apprenticeship period. Further, they are producing. Their work is directed and they are paid for it. The state assures them adequate instruction which will guarantee proficiency. In other words, a foundry apprentice may not be used as a handy man about the shop, doing a laborer's work for apprentice pay. The employer *must* provide instruction and the vocational school supervises and administers a portion of this instruction.

In Milwaukee at the present time, over 90,000 children are attending grade schools, 9000 are in the high schools and 28,000 between the ages of 14 and 20 are engaged in vocational study under the Wisconsin apprenticeship plan, learning on the job.

The Milwaukee Vocational school is intended to be universal to the greatest possible degree. The molder would not wish to see molding taught exclusively, for this would serve to flood the market with men equipped to compete with him on *his* work alone. Likewise, the shoe manufacturer, taxed to support the vocational school would have cause for complaint if molding alone were taught in the institution. He could not draw workmen from such a school. Consequently, the courses offered are expanded to meet the needs of the whole community for trained workers. All of the courses of study offered cannot be noted in this article, but the following brief list will serve to show the variety which is available to the apprentice: Printing, shoemaking, cobbling, auto repairing, electrical work, foundry work, patternmaking, plumbing, power plant operation, cooking, sewing, commercial art, baking, nursing, jewelry making, typewriting, chemistry, metallography, drafting, accountancy, commercial correspondence, bookkeeping, dressmaking, engraving, freight traffic, heat treatment, pharmacy, sheet metal construction, heat treating, and welding all are taught.

Foundrymen will be interested primarily in the work which is being done to teach young men the rudiments of foundry detail. Upsetting all previously formed opinion, young men actually seek entry to the various foundries of the city where they may become proficient in this line of work. No reference to unsatisfactory working conditions, to the dirt, grime and danger of foundry work, to the heat, dust and discomfort

PRACTICAL INSTRUCTION IS OFFERED IN WELL LIGHTED, COMPLETELY EQUIPPED SHOPS ABOVE—THE FOUNDRY LEFT—THE HEAT TREATING ROOM BELOW—THE PATTERN SHOP

of the foundrymen's life ever is made by those who are taking this training. On the contrary, some plants which have been singularly successful, have a waiting list of young men from which they may draw new apprentices. A probationary period and a course in preliminary or directional training serves to sift out the desirable candidates for foundry apprentice training. In other words, the employers as well as the apprentices are able to exercise a discretionary selection which tends to make the resulting indenture contract satisfactory to both parties.

All this is so contrary to accepted conception, so at variance with the problem of securing apprentices as set forth in foundry literature of the past decade that a more detailed study is desirable to find the underlying reasons.

Perhaps the whole credit for the success of the plan should not be assigned to the method adopted in Wisconsin for furnishing apprentice training. Undoubtedly, the personal element, the inspiration of men like R. L. Cooley, vocational school director, and F. A. Frommelt, apprentice director, the Falk Corp. has aided. Credit is due the active interested co-operation of such institutions as the Sivyer Steel Castings Co. with its allied interests, Allis Chalmers Mfg. Co., the Falk Corp. and other large enterprises. Without these agencies, working in full accord, the apprentice work might have fallen short. Too, that undefineable Milwaukee spirit, a community of interest unique in American industrial life also should be recognized. It has played a most important part.

Without seeking to go into minute details an outline of how the plan works at the plant of the Falk Corp., will prove interesting. At this enterprising plant the foundry presents the problems found in a department of a large manufacturing establishment combined with those of a jobbing shop. Five different departments of the Falk plant provide apprentice training. These are the foundry, machine shop, pattern shop, power plant and drafting room. A further differentiation is made between regularly indentured apprentices, voluntary apprentices, those established in the different lines and students from Marquette university or other colleges.

In selecting the regular apprentices, a probationary period is spent at the vocational school. This period averages about six weeks, although the time varies for different individuals. It is necessary for a boy to serve this time, during which he is under an instructor who explains the elements of the work the boy hopes to learn and who judges the candidate's aptitude for the line he has selected. At the close of the period if the boy elects to become a foundry apprentice and his ability and application are approved, he is indentured for a four-year period.

Thus the apprenticeship agreement is entered into with deliberation by both the apprentice and the employer, and when the indenture form is signed and one copy delivered to the boy, one to the company and one to the Wisconsin industrial commission, it bids fair to stand the test of the four-year period. Nor has the Falk company been obliged to defend the contract as a legal form during the six years or more since the plan has been in effect.

The indenture contract provides for definite periods of work in the different lines of training. For example, the regular form for a four-year apprentice gives eight periods of 1220 hours or a total of 9750 hours for the four years these are divided as follows:

Kind of Work	Hours
Helping Molding	400
Machine Molding	400
Bench Molding	650
Large Cores	700
Small Cores	650
Miscellaneous Floor Work	650
Heat Treating	600
Furnace	600
Green Sand Molding	1200
Dry Sand Molding	1200
Sweep Molding	850
Casting, Checking, Sand Mixing, Sifting, Crane Work, Time Study, Night work, etc.	1110
Chipping Room	750
	9760

The time distribution is general in character and may be varied at the discretion of the apprentice superintendent. In addition, a period of ½ day each week is assigned to the vocational school where the technical side of the work is presented. The apprentices are paid for their school time by the employing plant.

A graduated scale of wages is a part of the contract. The scale gradually rises from 22½ to 44 cents by eight gradations, and is supplemented by a bonus of $100 at the completion of the time. The hourly rate may be varied

AT THE FALK PLANT AND OTHER ESTABLISHMENTS, THE APPRENTICES ARE SEGREGATED UNDER INSTRUCTORS UNTIL THEY HAVE ATTAINED SUITABLE PROFICIENCY IN THEIR WORK

to correspond with changes in the rate paid to journeymen during the term of contract.

The Wisconsin law makes the vocational school instruction imperative for the first two years, but the Falk company is so convinced of the value of this training that it makes it available to its apprentices for the full four years. Further, the law is stringent in the enforcement of attendance at school, for the apprentice loses three hours pay for each hour of absence from school without good cause.

Competent instructors are supplied at the plant to teach the various branches outlined. The apprentices are responsible to their instructors directly, even when they have progressed to the point where they are working on the floor alongside full time journeymen. Their interests are conserved. Even when they have advanced to the point where they are capable of producing at full capacity, they are not held accountable. They are told what constitutes a day's work on the particular task at hand, but are not judged by the quantity of work which they produce. The fact that learning is their chief concern never is minimized.

The Falk company provides a period of ½ hour each week for discussing shop policy. At these periods, the apprentices are encouraged to bring up their individual problems relating to the business. The economic phases of modern industry are presented, by executives of the firm in a way which has proved to be the best sort of antidote for bolshevistic ideas.

It is interesting to note that welfare work, in the commonly accepted sense of paternalistic philanthropy is entirely absent from the relations between the company and the apprentices. The company agrees to teach the apprentices a trade, but does not seek to provide the frills which have served to discredit the efforts of some large establishments. The apprentices supply all the community spirit necessary. An *esprit de corps* has developed which speaks volumes for the way in which the apprentice regards the value of his training. At the Falk plant a voluntary organization has sprung up, supported by the contribution of an hour's pay from each apprentice each month. Meetings are held where the relationship of the individuals are discussed, sick visitation is planned and carried out, athletic competition is fostered and hobbies such as hiking, photography and other pursuits are encouraged through small groups. The boys in this way supply the school spirit, and feed the social yearning which is so well satisfied among college students.

At the present time, the Falk company has 40 probationary apprentices undergoing training at the Milwaukee vocational school. More than 65 are on the waiting list ready to enter on apprentice work. The total number of apprentices in foundry, machine shop, patternshop, power plant and drafting room, exclusive of the Marquette university, co-operative students is 165. When apprentice training was inaugurated about six years ago, only 17 candidates were indentured. Need one question the success of the training plan, from the standpoint of the apprentice?

Various interesting phases of the apprentice training idea have been developed through the experience of this company. The size and facilities of the company enable it to bear the expense of the training work, much better perhaps than could a smaller institution. Recognizing this fact, the metal trades employers, acting through a committee of which Harold Falk is chairman, has fostered the group plan of training. Under this plan, apprentices are indentured by the different companies, and then assigned to different plants to receive their training. Thus the Falk organization is teaching a number of apprentices, indentured by other firms. Similarly, some of the Falk apprentices are given an opportunity to work for periods varying up to two years, with other plants. At present a number are working at the plant of the Wesley Steel Treating Co., the Kinite Co. and other institutions, where they receive instruction along special lines. In fact, some 12 or more firms for a group of which the Falk organization is the parent factor.

A question is raised as to what becomes of apprentices in periods of industrial depression such as has just elapsed. When the plant is closed, the apprentices are assigned to the vocational school where they work full time at the expense of the company. Apprentices are encouraged to take night school instruction from the vocational school and at present more than 150 are registered for special work from the plant group. Boys in the third and fourth year put in full time on metallographic and heat treating work, while chemistry and metallurgy are offered to those whose previous school training has not supplied these needed subjects.

The details of the manner in which the apprentices are instructed in the shop have been explained in an able manner by H. A. Frommelt, director of apprentice training at the Falk plant, in articles in THE FOUNDRY, Sept. 1 and 15, 1923.

Tieing up closely with the vocational school, the company through its staff of trained men has advised with the instructional corps to evolve courses of study. The same is true with regard to other foundries in the district. A new plan is just being put in service to provide a series of lectures to be given to youngsters, defining the character of

DURING THE PAST WINTER THE MANUFACTURERS ENTERTAINED OVER FIVE HUNDRED APPRENTICES AT GET-ACQUAINTED DINNER CHARACTERIZED BY THE ABSENCE OF SET SPEECHES

work and the opportunities offered in various lines of endeavor. Foundry and allied careers will be represented.

It is interesting to note that the viewpoint of the other fellow is regarded in laying out the courses of study. The foundry apprentice must learn a bit of patternmaking, and drafting which as all must recognize must inculcate a respect for his fellow workman with whom he comes in contact.

Sufficient mathematics is a requirement. Blueprint reading, shop sketching, metallurgy and the properties of materials, composition of sand and similar related subjects are taught through the school and the shop. In more advanced work, the theoretical side of the business is presented. From specifications for a given production on a certain line of castings, students must design a plant with all equipment, layout the work as to men required, and finally estimate the cost of production from a fictitious plant and co-ordinate the various units.

The co-operation of parents is encouraged, through a system of reports. The boy is regarded as a human being entitled to respect, and to the thoughtful consideration of the management obligated to teach him a trade. However, this interest is not rendered intrusive.

Although not within the Milwaukee district, the Bucyrus Co., South Milwaukee, Wis., furnishes an interesting example of the manner in which the Wisconsin apprentice training plan operates in smaller localities. This company employs 500 men in the foundry and has but two or three indentured apprentices. However, apprentice training on a voluntary basis is provided for about 30 individuals, who elect to work as apprentices for two or three-year periods. Up to the present time, eight have completed such courses with satisfaction to themselves and to their employers. In providing the training the company offers four periods of instruction of 1375 hours each, making a total of 5500 hours. A probationary period of 60 days is provided. A waiting list is reported by H. M. Anderson, director of apprentices and employment manager.

An illuminating commentary on the value of the instruction to the apprentice is furnished by the fact that five or six different individuals ended their voluntary apprentice agreement and left the company and afterward returned, willing to start at the bottom to make up what they had lost. L. Fyling, an apprentice who had worked only nine months made a gear wheel which was exhibited at the state fair and proved to equal the work made by experienced molders. A graded scale of payment is offered as in the case of the Falk apprentices and further a bonus on piece work is paid which has a tendency to stimulate their best efforts.

Propose Standard Pattern Equipmet

BY H. O. HAUGHTON

DESIRABILITY of adopting uniform practice in the application of patterns and equipment to molding machines led the American Foundrymen's association to appoint a committee to study the subject. Later other associations connected with the metal trades were induced to co-operate in the work. Associations now interested in addition to the American Foundrymen's association include: American Institute of Mining & Metallurgical Engineers, American Malleable Castings association, American Society for Testing Materials, Foundry Equipment Manufacturers association, National Association of Pattern Manufacturers, National Association of Purchasing Agents, Steel Founders Research group. The augmental body is known as the joint committee on pattern standardization. The first definite move was made in the spring of 1924 when the chairman E. S. Carman, Osborn Manufacturing Co., Cleveland, secured the services of a young engineer and installed him on a full time schedule to make a start on tentative plans.

The work has been divided into three parts, patternmaking and marking; pattern plates and mounting; flask size and details. A subcommittee made up of a chairman and four or five members competent to deal in detail with the subject has been appointed to work out the problem involved in each division. As a preliminary to later activities the various subcommittees intend to send questionnaires to a large list of foundrymen with a view of securing as universal an opinion as possible. The questionnaire carries drawings and tabulations of the proposed standards.

The general chairman proposes to base all tentative proposals on existing practice as exemplified in representative foundries. In other words whatever is best in old and tried practice will be retained rather than attempt the adoption of seemingly radical ideas. The plan in general provides for a set of flasks equipped with standard fittings to use in connection with a standard pattern plate adapted to use with a molding machine. This arrangement would be particularly applicable under circumstances where relatively short orders would not justify special flask equipment.

In the preliminary proposals for pattern marking, surfaces designed on the casting to be left unfinished are painted black. Machined surfaces are to be painted yellow. Core prints will be red. Seats for loose pieces simply will be varnished with clear shellac. Stop-off pieces will not be painted with the exception of a row of diagonal black stripes. A space has been provided on the questionnaire to record an opinion favoring other colors for steel, malleable iron, or ferrous metals.

Under the second heading a standard plate has been proposed. The plates correspond with the standard flask sizes and are shown on the questionnaire sheets bolted to the machine table and with the flask in place. Dimensions and other details are shown in the sketch.

The flasks are designed in four sizes and range in length from 20 inches to 108 inches. Comments and criticism of the subcommittee members will form the basis for discussion when the revised proposals finally are taken up by the general committee with a view of approval of tentative standards.

Plan Unusual Program

A novel program for a future association meeting has been planned by New England Foundrymen association. A casting of complicated design is to be selected and given to six or eight prominent foundries, each of wihch will endeavor to make a duplicate casting as easily and simply as possible. Ten each of the foundrymen or foundry superintendents engaged in the actual work will tell his experiences at the meeting. In this way many valuable points are expected to be brought out covering different methods of foundry practice.

Limestone is a carbonate of lime $CaCO_3$. It occurs in several forms such as marble, oyster shells, calcite and ordinary limestone. The first three mentioned will run 99 per cent calcium carbonate, while the ordinary limestone will run as low as 75 per cent $CaCO_3$ and as high as 96 to 98 per cent $CaCO_3$. It is always best to use highest grade limestone for foundry purposes.

Milwaukee Again A.F.A. Host

Wisconsin Industrial Center Entertains American Foundrymen's Association for Third Time—Was Host to War Time Gathering in 1918

THOSE whose fortune permits them again to visit Milwaukee on occasion of the American Foundrymen's association convention and who also were present during the week of Oct. 7, 1918, cannot be unmindful of contrasting conditions. Then war's full stress lay heavy on the country. All industry worked to achieve a single aim. Win the war was the slogan, creed and precept.

It will be recalled that the character of exhibits, technical discussions and individual conversation all shaped along this single line. Frowning guns and sanguinary shell greeted the registrant as he entered the Milwaukee auditorium. Distinguished army officers of technical missions sent by our allies were present. Charles M. Schwab, who was building the emergency fleet, stressed strongly the duty of industry in his speech at the banquet to which thousands sought admission.

Those who journey to Milwaukee for the week of Oct. 11-16, 1924, have not the urge of public or patriotic motives so strongly placed before them. However, a no less insistent reason will actuate many there present. Foundrymen will gather to bring their contributions to the store of common knowledge. They will draw therefrom technical information of great value to them in today's industrial battle. They will seek how they may better production methods, improve equipment, eliminate distressing and expensive losses and in other ways meet the new competitive conditions which have arisen in the field of castings manufacture.

Those who have planned the conventions, together with the manufacturers of equipment and supplies who are placing before the industry the best they have to offer, have had these facts in mind. The technical program, the arrangement of group sessions and the exhibition all have a bearing on the question of the hour. An unusual opportunity awaits those who will be present and a pleasant visit is assured by the local committee.

All activities will center in Milwaukee's extensive municipal auditorium, one of the first of its kind in the country, and a structure well adapted to the purposes at hand. Registration, technical sessions, the exhibition and the control of entertainment and plant visitation trips will center there.

Milwaukee a Leader in Iron and Steel

INDUSTRIAL growth and development of the city of Milwaukee has been due largely to its geographical location and to the excellent facilities available for commerce. The choice of a site rested with a tribe of Indians that first settled there and attracted traders to the spot. These first white settlers selected this spot, not because of the adaptability of the soil for agricultural purposes or the advantageous position with reference to commerce, but to buy the furs brought into the settlement by the Indian tribe. On Sept. 14, 1818, Solomon Juneau and Jacques Vieau, his father-in-law, landed at the mouth of Man-ah-wauk-ee seep and established a trading post which was to grow in 100 years to a city of approximately one half a million people.

It is natural that commerce was the main activity of the settlement during its early history. Grain and timber from the great Northwest soon found its way into the settlement and there was loaded on boats for transportation to earlier settled points on the eastern lakes. The men engaged in this business soon realized that it would be more profitable to ship the flour and lumber instead of the raw materials, so that mills were constructed along the river to grind the wheat into flour and saw the timber.

The early history of the metal industry in Wisconsin is associated closely with the growth of the milling industry in that state. Since the cost of bringing the milling machinery from the East was high and the time lost in making repairs was excessive, foundries and metalworking plants were established to make the machinery and necessary repairs. As the milling industry grew, the foundries increased in proportion and the foundries, which were established in the early forties, constituted the beginning of the present day foundry center in Milwaukee. In many cases the large shops now operating in the district are the outgrowth of the foundries which were started in a small way in the period immediately before and after the Civil war.

The first plant for pouring metals was established in 1842 when Egbert Mosley, Loring Dewey and Stephen Newhall came to Milwaukee from Detroit and built a small foundry and machine shop between the mills of E. Sanderson & Co. and J. B. Kerns. The following year B. Bagnall & Co. started a small foundry on the river bank. In 1844 this foundry was purchased by Turton & Sercomb and became the nucleus of a large business in mill work and steam engines.

The Reliance Works was established in 1847 to make mill stones and a short time later a foundry and machine shop were added. At that time this was the only complete mill furnishing establishment in the country. The plant was was purchased in 1860 by Edward P. Allis, Charles D. Nash and John P. McGregor and was operated under the name of the E. P. Allis & Co. The entire stock of the company was purchased later by Mr. Allis, the great Allis-Chalmers Mfg. Co. being a direct descendent of this company. The Reliance Works grew rapidly and plants were established in Cincinnati and Chicago. Later it became apparent that greater space for enlargement would be necessary and a site in West Allis was purchased, the Reliance Works being practically discontinued.

The Cream City Iron Works was established in 1869 by Messrs. Filer, Stowell and Pierce. The company engaged in a general foundry and machine shop business and built saw mills, grist mills, etc. In 1875 the Milwaukee Middlings Millstone Co. was incorporated to manufacture certain patented milling apparatus designed for the reduction of

wheat to flour in its different stages. While the first plants were developed to furnish machinery for the mills, the iron and steel business soon was steam engines, and other diversified lines. Industrial activity received considerable impetus in the period following the Civil war. Brant & Co. was established in territory. At that time there were 18 gray iron foundries with a capacity of about 80,000 tons per year. A wide variety of machinery utilized the most

Tentative Program of Technical Papers

Monday, October 13

Nonferrous—Joint session with Institute of Metals division A. I. M. E.

Afternoon—Making Copper Castings from Cupola Melted Metals, by T. F. Jennings, Garfield, Utah.
Modern Bell Founding, by Wesley Lambert and G. Hall, London, England. Annual Institute of British Foundrymen exchange paper.
Founding of Brass in Mexico, by H. H. Miller, Torreon, Coa, Mexico.
Art Bronze Work, by J. F. Arnold, Mt. Vernon, N. Y.
Recuperation in Connection with Brass Melting, by H. D. Savage, Combustion Engineering Corp., New York.
Report of Committee on Nonferrous Metals.
The Copper Refining Industry. Film by the Baltimore Copper Smelting & Refining Co.

Steel Foundry Topics

Afternoon—Broadening the Field for Steel Castings Through the Use of Alloys and Heat Treatment, by F. Grotta, Holt Mfg. Co., Peoria, Ill.
Report of committee on steel castings.
Report of committee on refractories.
The Microscope as a Controlling Instrument in Annealing Steel Castings by J. F. Harper and H. J. Stein, Allis-Chalmers Co., Milwaukee.
The Heat Treatment of Steel Valve Castings in the Electric Furnace, by V. T. Malcolm, and A. Sprout, Chapman Valve Co., Indian Orchard, Mass.

Tuesday, October 14

Aluminum and Aluminum Alloys, Joint Session with the Institute of Metals Division A. I. M. E.

Morning—Production of Aluminum Alloy Pistons in Permanent Molds by R. J. Anderson, Consulting Metallurgical Engineer, Boston, and M. E. Boyd, Clinton, Mich.
Aluminum-Silicon Alloys by D. Basch, General Electric Co., and M. F. Sayre, Union college, Schenectady, N. Y.
Aluminum Alloy Castings from Sheet Scrap, by H. C. Knerr, Philadelphia.
Salvage of Aluminum Alloy Castings by Welding and Soldering, by R. J. Anderson, Boston, and M. E. Boyd, Clinton, Mich.
Alpax, a New Development of Aluminum Alloys, by Dr. Guillet, Paris, France.

Steel Foundry Practice

Morning—Report of A. F. A. representative on joint investigation of phosphorus and sulphur in steel.
Organization and Practice in a Steel Foundry Finishing Room, by C. W. Heywood, Burnside Steel Co., Chicago.
Notes on the Overall Performance of Acid Electric Furnaces by T. S. Quinn, Lebanon Steel Foundry, Lebanon, Pa.
X-Rays in the Foundry, by Dr. Ancel St. John, New York.
Report of committee on Heat treatment of ferrous castings.

Apprentice Training Methods

Morning—First Division—Employers and Executives.
The Employers Expectation of Apprenticeship, by R. J. Doty, Sivyer Steel Casting Co., Milwaukee.
The Milwaukee District Program, by H. S. Falk, The Falk Corp., Milwaukee.
The Milwaukee Continuation School, by M. S. Cooley, director Milwaukee Continuation school.
Second Division—District Apprenticeship Convocation.
Apprenticeship from Apprentice Viewpoint, by J. Edwards.
Why I Talk Apprenticeship, by C. Freund.
Discussion.
This program will be supplemented by an actual working demonstration of the Falk Corp. apprenticeship department which for the convention week will be located in a booth in the convention hall. Inspection trips to plants operating apprentice departments will also be arranged.

Sand Research Developments

Afternoon—Report of Chairman of Joint Committee on Molding Sand Research.
Report of Chairman of Subcommittee on Tests of Joint Committee on Molding Sand Research.
Development and Comparison of Permeability Testing Apparatus, by T. C. Adams, Cornell university, Ithaca, N. Y.
Relation of Water to Bond and Permeability, by C. R. Nevin, Cornell university, Ithaca, N. Y.
The Physical Properties of Foundry Sand, by C. A. Hansen, General Electric Co., Schenectady, N. Y.
Illinois Foundry Sand Resources, by M. M. Leighton, Director Illinois Geological Survey.
Commercial Application of Molding Sand Testing, by H. W. Dietert, United States Radiator Corp., Detroit.
A Study of the Effect of Heat on the Clay Content of Molding Sands, as Shown by the Dye Adsorption Test, by Messrs. R. F. Harrington, W. L. MacComb and M. A. Hosmer, The Hunt Spiller Mfg. Co., Boston.

Special Session of the Institute of Metals Division of the A. I. M. M. E.

Afternoon—Casting and Heat Treatment of Some Aluminum-Copper Magnesium Alloys, by Samuel Daniels, A. J. Lyon and J. B. Johnson, Engineering division Air Service, Dayton, O.
Experiments on the Heat Treatment of Alpha-Beta Brass by O. W. Ellis and D. A. Schemnitz, Toronto, Ont.
Coating Formed on Corroded Metals and Alloys, by George M. Enos and Robert J. Anderson.
Notes on Hardness of Heat-Treated Aluminum Bronze, by George F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Wednesday, October 15

Sand Research—Geological Survey Work

Afternoon—Report of Subcommittee on Geological Surveys.
Report of Subcommittee on Conservation and Reclamation.
Notes on the Grading of Sands by C. R. Nevin, Cornell university, Ithaca, N. Y.
An Exhaustive Study of Various Molding Sand Mixtures, Together with the Physical Properties of the Molds and Castings Produced, by Messrs. Harrington, Wright and Hosmer, Hunt Spiller Mfg. Corp., Boston.
A Mold Hardness Tester, by E. Ronceray, Ph. Bonvillain & E. Ronceray, Thiais, France.
The Effect of Moisture, Silt and Clay Content on Various Molding Sand Mixtures, by Messrs. Harrington, Wright and Hosmer, Hunt Spiller Mfg. Corp., Boston.
Molding Sand Reclamation and Control Experiments, by F. L. Wolf and A. A. Grubb, Ohio Brass Co., Mansfield, O.

Electric Furnace

Electric Furnace Gray Iron, by E. L. Wilson, The F. J. Ryan Co., Philadelphia.
The Electric Furnace in the Pipe Foundry, by J. T. McKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Report of committee on corrosion of ferrous metals.
First report of soil corrosion investigation conducted by the bureau of standards.
Report of committee on coke.

Business Session

Afternoon—Report of Officers.
Presentation of major awards.
A World Outlook for American Foundrymen, by H. Cole Estep, Cleveland.

Industrial Relations Session

Cost Finding in a Foundry, by W. J. Corbett, Electric Steel Founders Research Group, Chicago.
Departmental Costs in the Foundry, by H. B. May, W. K. Henderson Iron Works and Supply Co., Shreveport, La.
Report of committee on costs.
Report of joint committee on pattern standardization.

Thursday, October 16

Malleable Cast Iron Practice

Morning—Report of Committee on Malleable Cast Iron.
Oxidation Losses in Melting, by H. A. Schwartz, National Malleable and Steel Casting Co., Cleveland.
Broadening an Industry's Horizon, by C. L. Eshleman, American Malleable Casting association, Cleveland.
The Mechanism for Graphitization of White Cast Iron and its Application to the Malleablizing Process, by A. Hayes and W. J. Diederichs, and H. E. Flanders, Iowa State College, Ames, Iowa.

Gray Iron Session

Afternoon—Melting Steel in a Cupola, by J. Grennan, University of Michigan, Ann Arbor, Mich.
Report of committee on cast iron.
Notes on Composition and Structure of A. S. T. M. Bar, by J. W. Bolton, Niles Tool Works, Hamilton, Ohio.
An Investigation of Chill Iron, by E. J. Lowry, Hickman-Williams Co., Chicago.
Characteristics that Chemical Analysis Fails to Disclose in Pig Iron and Castings, by W. E. Jominy, University of Michigan, Ann Arbor, Mich.
Testing Iron to Control the Properties of Castings, by G. W. Gilderman, Dodge Bros. Mfg. Co., Mishawaka, Ind.

well established and other business was attracted to the city. Foundries were established to make castings for builders of other types of machinery, including 1872 to manufacture cast iron stoves.

In the early nineties the country as a whole began to realize the development that had taken place in the Milwaukee of this output, while a portion was used for car building. Only two or three malleable plants were in operation with an output of approximately

15,000 tons per year. The city began to be recognized as a machinery manufacturing center, there being about 40 builders of various types of machines in the territory. Heavy machinery from the city was found in almost every state in the Union. The city became a leader in the production of steel castings when the Falk Steel Casting Co. was declared one of the largest in the country in 1907, with the George H. Smith Steel Casting Co. second and other steel foundries in the Milwaukee territory near the top of the list.

Today, Milwaukee has about 2600 large factories representing more than 100 separate lines of industry. Seventy-three foundries are located in the city, and in the Metropolitan district outside of Milwaukee 18 more casting plants are found. The iron and steel products manufactured in this district are exceedingly diversified and find a market not only in America, but also in practically every civilized country. The city is considered one of the largest steel casting centers in the country and some of the largest steel and gray iron castings that have been made in this country have been poured in Milwaukee. The city still maintains its position as a leader in the manufacture of machinery and is noted especially for some of the large work turned out. Water pumping, ice making and refrigeration machinery is produced in large quantities and considerable excavating machinery is manufactured in the city for export. Plants in the territory have turned out large Diesel engines, Uniflow engines and a majority of the gas engines manufactured in the country.

A large and well equipped plant for the manufacture of electric traveling cranes and hoists is located in the city and some of the largest mine hoist units in the world are built there. Milwaukee is the home of the third largest locomotive and car works in the United States and the largest owned by a railroad corporation. It is said that the city leads the country in the manufacture of herring-bone gears for power transmission and in gasoline locomotives for mining and plantation use. In addition to the previously mentioned products, the following are manufactured extensively in the city: Saw-mill machinery, detachable motors for boats, motorcycles, automobile accessories, and enameled ware.

The metal trades is the leading industrial line in Milwaukee. The total value of products manufactured in the city in 1922, the last year for which figures are available, was $822,690,487, of which $214,166,835 represents the value of the products manufactured by the metal trades industry. The city is noted as a center for the manufacture of food products and in 1922 this product ranked second, but the value of the product was only $102,072,631, or less than one half the value of the iron and steel products. The metal industries exported products valued at $8,532,184 in 1922.

The analysis of the products of the metal trades industry should prove interesting. In 1922, iron, steel and heavy machinery lead with a total of $95,119,370, the remainder of the manufactured products being distributed as follows: Agricultural implements and farm equipment, $9,630,172; electric supplies, $14,623,430; electroplating, $253,458; furnaces and stoves, $7,034,427; hardware, $528,680; motor vehicles, parts and accessories, $65,178,024; plumbing and steam fitting supplies, $4,442,265; stamped and enameled goods, $4,192,423; structural iron and wire goods, $6,462,091; sheet metal goods, $5,997,650; wire goods, $704,845.

Since the organization of the American Foundrymen's association, 28 years ago, an outstanding feature of the annual meetings has been the reading and discussion of the technical papers. At the organization meeting held in Philadelphia, June 12, 13 and 14, 1896, eight technical papers were presented. During the intervening years, there has been a steady increase in the number of papers presented, covering more diversified subjects and reaching a higher standard of attainment. These papers always have portrayed a continued forward movement along the various lines of research and endeavor, thus keeping the industry in the front rank of national progress. These technical sessions have been a school of advance thought, a forum and a meeting place of the most progressive foundrymen.

This year's tentative program has been arranged by the committee on papers, composed of the following:

Program and Papers Committee

E. F. Cone, chairman, *The Iron Age*, New York.
R. E. Kennedy, secretary, Urbana, Ill.

Gray Iron and Miscellaneous Section.

E. L. Shaner, chairman, Penton Publishing Co., Cleveland.
J. Fletcher Harper, Allis-Chalmers Manufacturing Co., Milwaukee.
A. B. Root Jr., Hunt Spiller Manufacturing Corp., Boston.

Steel Casting Section

R. J. Doty, chairman, Sivyer Steel Casting Co., Milwaukee.
A. W. Gregg, Bucyrus Co., South Milwaukee.
A. W. Lorenz, Bucyrus Co., South Milwaukee.

Malleable Casting Section

W. R. Bean, chairman, Eastern Malleable Iron Co., Naugatuck, Conn.

Co-ordination Fostered by Exchange Papers

Papers Contributed by Institute of British Foundrymen to American Foundrymen's Association

1922—American versus British Cast Iron, by F. J. Cook, Past President, I. B. F.

1923—British Foundry Practice, by Percy Longmuir, Past Director, British Cast Iron Research association.

1924—British Bell Founding Methods, by Wesley Lambert, Member of Council, I. B. F., and George Hall.

Papers Contributed by American Foundrymen's Association to French Foundrymen's Association

1922—Malleable Iron Castings, by Prof. A. E. White and H. E. Gladhill.

1923—The Bonding Substance of Molding Sands, by H. B. Hanley, Rochester, N. Y.

1923—Testing Cast Iron, by Dr. Richard Moldenke.

Papers Contributed by French Foundrymen's Association to American Foundrymen's Association

1922—Destruction and Reconstruction of French Foundries, a Memoir submitted by the Association Technique de Fonderie de France.

1922—European versus American Molding Machines, by E. V. Ronceray, Treasurer, A. T. F.

1922—A New French Electric Furnace, by R. Sylvany.

1922—A European View of the Malleable Problem, by T. Levoz.

1923—Aluminum and Light Alloys, by M. de Fleury.

1923—Address by Emil Ramas, President, A. T. F.

Paper Contributed by Belgian Foundrymen's Association to American Foundrymen's Association

1922—Making Typewriter Frames in a Belgian Foundry, by Joseph Leonard, Past President, A. T. F. de Belgique.

Papers Contributed by American Foundrymen's Association to Institute of British Foundrymen

1921—The Basic Hearth Electrical Furnace and Some Problems of Cast Iron, by George K. Elliott, Cincinnati.

1922—American Methods of Manufacturing Malleable Iron Castings, by Prof. Enrique Touceda, consultant, American Malleable Castings association.

1923—American Methods of Producing Steel Castings, by R. A. Bull, Past President, A. F. A.

1924—The Production of Castings in Permanent Molds, by Robert J. Anderson, United States Bureau of Mines, and Edward M. Boyd.

R. A. Rourse, The Stowell Co., Milwaukee.
H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

Nonferrous Section

R. J. Anderson, chairman, Boston.
Jesse L. Jones, Westinghouse Electrical & Mfg. Co., East Pittsburgh, Pa.
N. K. B. Patch, Lumen Bearing Co., Buffalo.

Industrial Relations Section

C. B. Connelley, chairman, Carnegie Institute of Technology, Pittsburgh.
Edward Frohman, S. Obermayer Co., Pittsburgh.
Arthur Young, Curtis, Fosdick & Belknap, New York.

The meetings will cover 12 sessions, which will include two joint sessions with the metals division of the American Institute of Mining and Metallurgical Engineers. At these various sessions 59 technical papers and reports will be presented.

The exchange paper with the Institute of British Foundrymen, to be delivered at the Milwaukee convention will deal with ancient and modern bell founding. The authors of this paper are Wesley Lambert, who is a member of council of the Institute of British Foundrymen, and is connected with the firm of J. Stone & Co., Ltd., of Deptford, London, and George Hall, a member of council of the London branch of the Institute of British Foundrymen. This paper is divided into three parts. The first gives the history of bells, the second covers the old and the new method of founding, and the third treats on the metallurgical problems, such as melting, mixtures used, etc. The general papers and reports will cover nonferrous metals, steel foundry topics, aluminum and aluminum alloys, apprentice training, sand research, heat treatment of nonferrous metals, corrosion of metals, electric furnace practice, malleable cast iron, gray iron foundry cost keeping, and pattern standardization.

Those who avail themselves of the advantages offered in hearing these technical papers read and the valuable discussions which follow, will receive an intensive course in general foundry instruction, and will become acquainted with the best thought and latest practice.

Plan Interesting Social Features

THE local committee of foundrymen has been busy arranging the social entertainment features of the convention. The Palace theater has been reserved for Tuesday evening, Oct. 14, and the foundrymen and guests will be given a theater party. After the theater party, a dance will be held at the Arcadia ballroom, Milwaukee's newest and most modern dance floor. In building the Arcadia, much thought was given to the comfort of the guests and the interior of the room is beautiful. The annual banquet of the association will be held Wednesday evening. An entertaining program is being prepared for this occasion and will be announced later. After the banquet a dance will be held.

Arrangements have been made for those wishing to play golf. The various courses at Milwaukee are in exceptionally fine condition, due to the unusual amount of rain which has fallen during the summer and the fact that the weather has been cool. An information booth will be established at the Auditorium where tickets for the various features may be obtained and where complete information will be available on the various entertainment features of the week.

Milwaukee, the industrial metropolis of Wisconsin and the center of the casting industry for the territory west of Lake Michigan, offers excellent op-

(*Concluded on Page 775*)

Milwaukee Committee Sponsors Pleasure Plans

Executive Committee

Emil Vilter, chairman—Vilter Mfg. Co.
R. J. Doty, vice chairman—Sivyer Steel Casting Co.
Fred Luening—Milwaukee Journal.
J. J. McDevitt—S. S. Obermayer Co.
A. E. Harrison—Allis-Chalmers Mfg. Co.
John D. Bird—American National Bank.
R. L. Baldwin—Republic Carbon Co.
C. R. Messinger—Chain Belt Co.
Irving Gilpatrick—Hotel Gilpatrick.
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Harold Falk—Falk Corporation.
Chas. Dunlop—Goodrich Transit Co.
R. A. Nourse—The Stowell Co.
R. J. Doty—Sivyer Steel Casting Co.
A. J. Lindeman—Lindeman & Hoverson Co.
Julius Heil—The Heil Co.

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A. E. Harrison—Allis-Chalmers Mfg. Co.

Golf Committee

John D. Bird, chairman—American National Bank.
Ralph MacPherran—Allis-Chalmers Mfg. Co.
David McLain—McLain System, Inc.

Ladies' Entertainment Committee

R. L. Baldwin, chairman—Republic Carbon Co.

Mrs. Emil Vilter	Mrs. R. A. Nourse
Mrs. R. J. Doty	Mrs. R. P. Tell
Mrs. J. J. McDevitt	Mrs. L. C. Wilson
Mrs. F. W. Luening	Mrs. A. M. Jones
Mrs. John D. Bird	Mrs. B. C. Wait
Mrs. Albert Harrison	Mrs. Irving Gilpatrick
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Charles Dunlop—Goodrich Transit Co.

Public Stru
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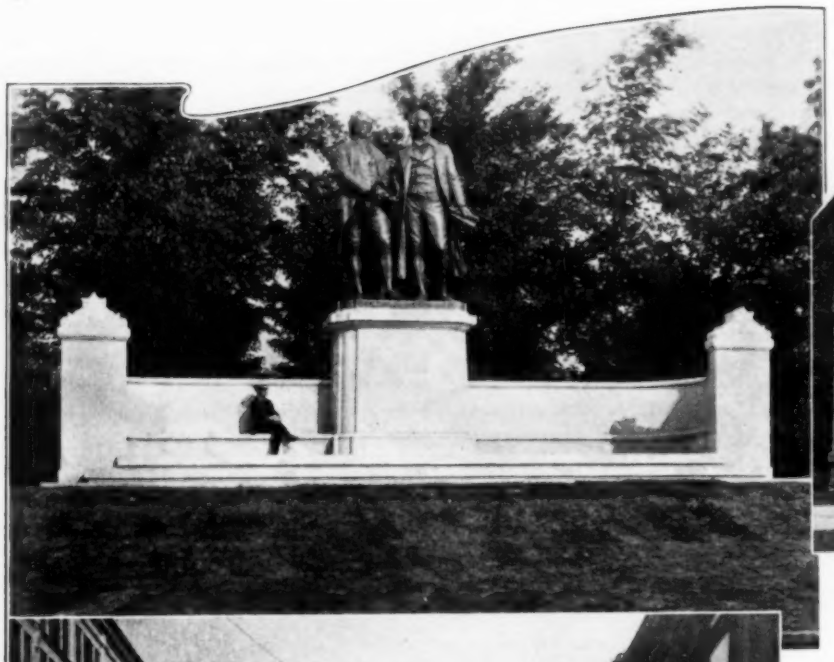
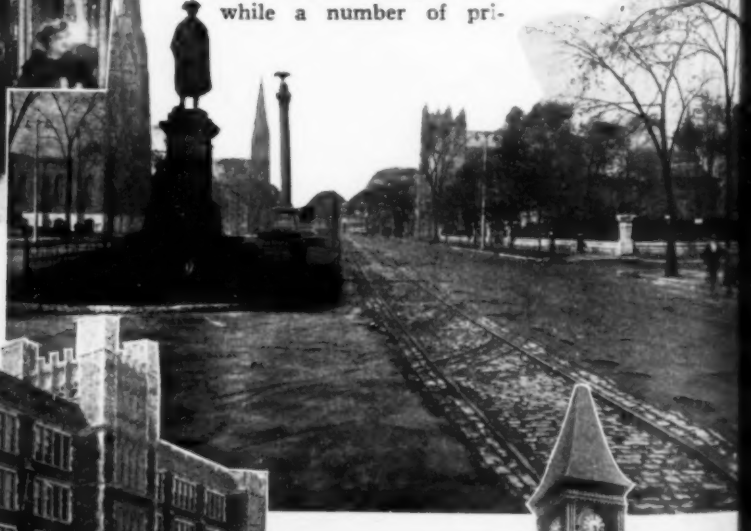
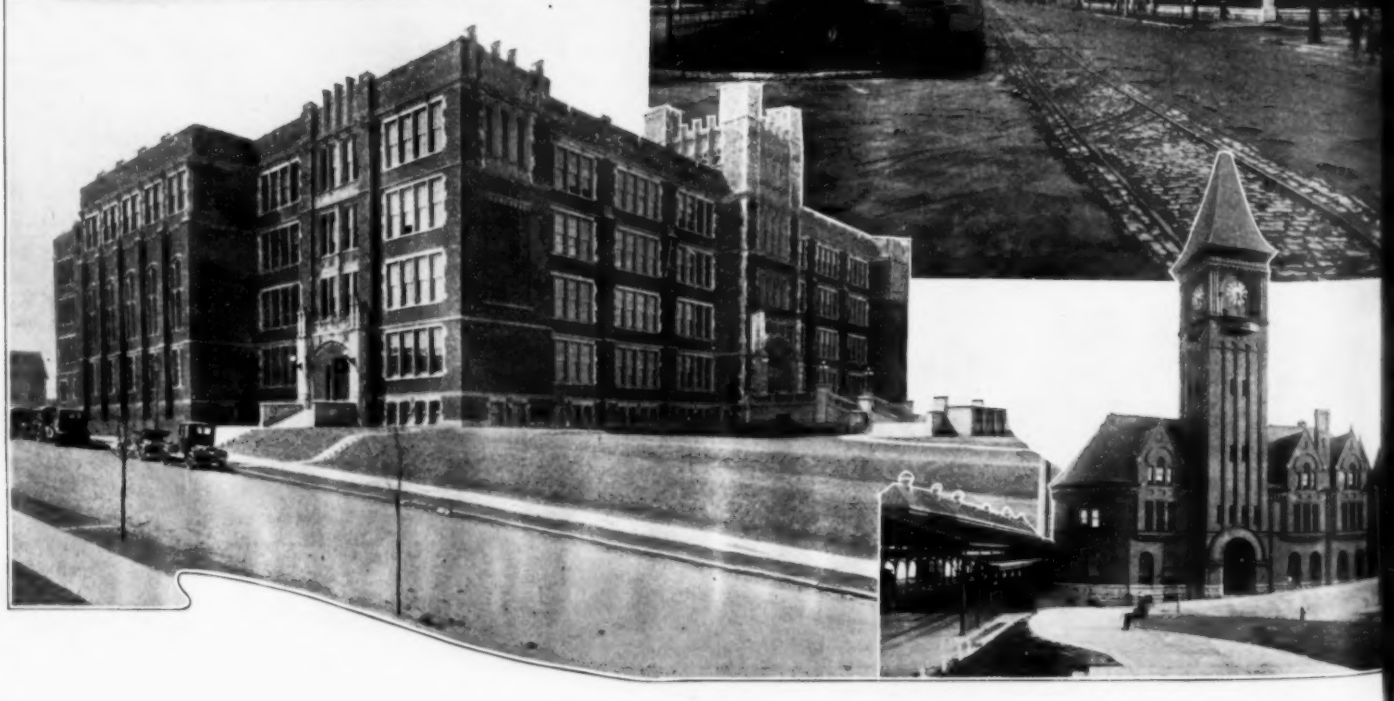


MILWAUKEE, one of the foremost manufacturing centers in the country, at the same time is acknowledged as a most beautiful place of residence. The manufacturing district lies in the valley, while the surrounding elevations afford delightful home sections. An extensive system of beautiful parks is connected by broad boulevards, the leading parks being Washington and Zoo, Lake, Mitchell, Humbolt, Riverside, Juneau, Reservoir and Kosciusko. Many of the parks are provided with artificial lakes suitable for boating in the summer and skating in winter. Public golf courses are maintained at Lake, Lincoln, Grant, South Shore and Bradley parks, while a number of pri-





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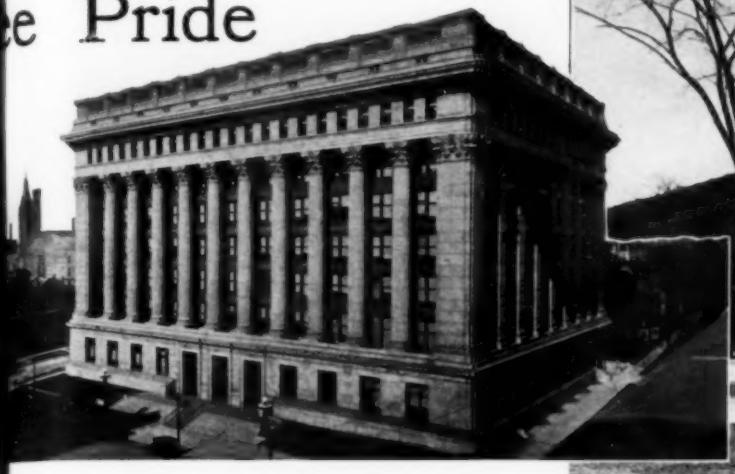
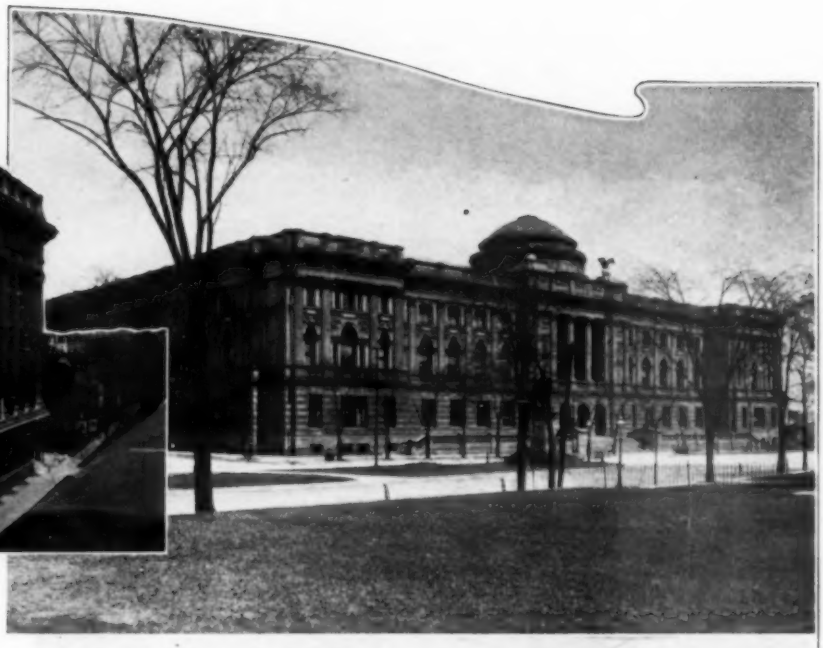
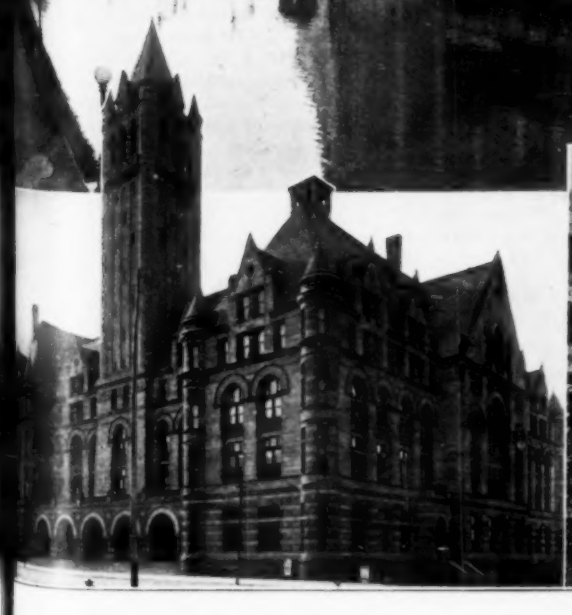
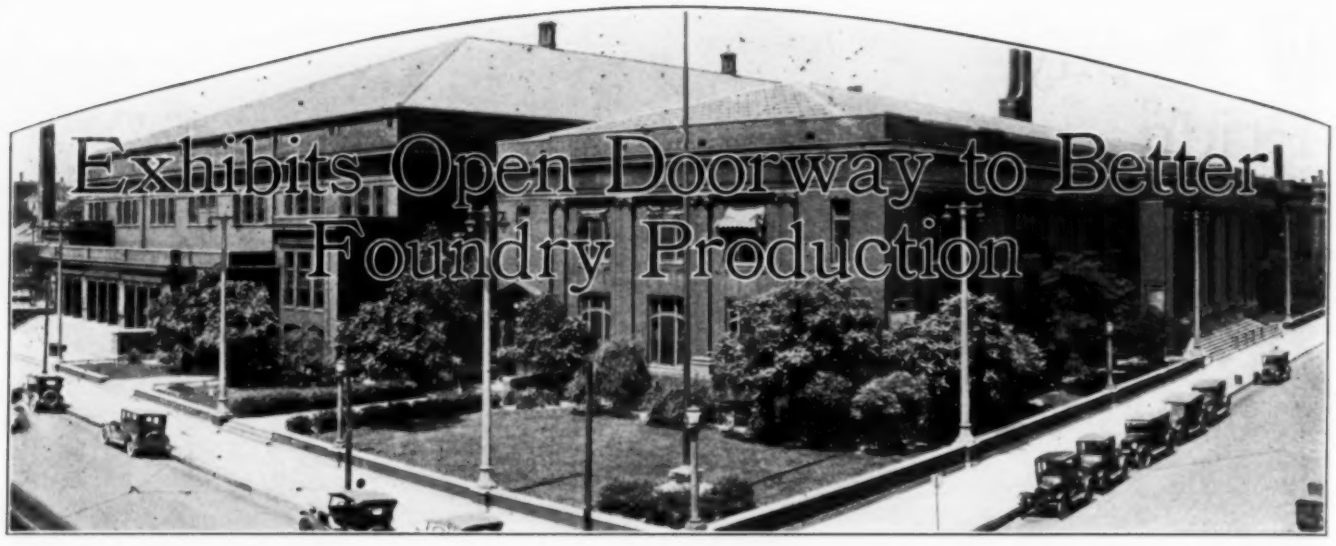




vate courses are located in and around the city. In addition to the public school system, the city has a splendid system of private schools and institutions for academic college education, Marquette university and Milwaukee-Downer college being included in the latter. Milwaukee has many beautiful churches, hotels, theaters, business blocks, hospitals and other public buildings including the auditorium, the library and museum, city hall, post office, and the various depots. Industrially the points of interest are many, and while diversified, are exceptionally plentiful in iron and steel. The harbor at Milwaukee has aided materially in the growth of the city, and at present is being developed under a commission.





Exhibits Open Doorway to Better Foundry Production

ABRASIVE INDUSTRY, Cleveland—This booth will be fitted up as a rest room where those in attendance at the convention are invited to make their headquarters. The representatives will be John A. Penton, A. O. Backert, J. D. Pease, F. V. Cole, H. Cole Estep, G. B. Howarth and J. F. Ahrens.

ADAMS CO., Dubuque, Ia.—This company will show portable and stationary jolt air squeezers, portable hand squeezers, pneumatic sand riddles, snap flasks, steel jackets, steel bands, tubular steel sprue cutters, pneumatic rappers and vibrators. The air squeezers will be in operation to show the jolt piston, service valve and pressure regulator. The representatives will be A. J. Goss, Lester Demkier, and John B. Meyer.

ADVANCE MILLING CO., Chicago—A core binder and sample cores made from this binder will be shown by this company. The representatives will be Joseph Remmes and D. T. McGrory.

AIR REDUCTION SALES CO., New York—This company will display oxygen and acetylene cylinders and certain foundry practices will be reproduced. The company will be represented by L. W. Hughes, F. Maeurer, S. Shaykin, Charles Williams, E. L. Fiddyment and W. P. Roberts.

AJAX METAL CO., Philadelphia—Brass, bronze and other nonferrous alloys in ingots and castings, a special bearing alloy and an electric furnace for melting brass will be on exhibition. The company will be represented by G. H. Clamer, W. J. Coane, F. M. Willeson, Zeno D. Barns, John G. Miller, Henry Gieseke and Robert N. Blakeslee.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—Various grades of sand produced by this company will be on display and a rest room will be maintained. The booth will be in charge of Lawrence Murray and Mr. Stokes.

ALLAN MFG. & WELDING CO., INC., Buffalo—In addition to its regular line of arc welding transformers, this company will exhibit a new arc welding generator recently placed on the market. Robert Siemer will be in charge.

ALLOYS & PRODUCTS, INC., New York—More than 150 alloys used in brass foundry practice will be on display at the booth of this company.

AMERICAN FOUNDRY EQUIPMENT CO., New York—This company will show sand cutters, sand-blast equipment, dust arresters, molding machines, snap flasks, steel adjustable jackets, pattern mounting compound, hammer core machines and flask bars. The representatives will be Verne E. Minich, Robert H. Kelley, Elmer A. Rich, H. H. Haley, James Rigby Jr., J. D. Alexander, S. H. Baird, Chas. L. Benham, C. G. Smith, David Logan, Chas. Rose, J. E. Sweet, E J. Turnbull, G. H. Walsh, R. H. Moore, A. H Freeman, R C. Coburn and Mr Schulte.

AMERICAN METAL MARKET CO., New York—

AMERICAN VENT WAX CO., Lockport, N. Y.—This company will exhibit various sizes of vent wax used for cores as well as numerous cores in which this wax is used. The company will be represented by Nelson L. Nankey.

AMES SHOVEL & TOOL CO., Boston—This company will show a complete line of molders shovels, scoops, etc. It also will show shovels of its manufacture which were made prior to 1812. The company will be represented by A. C. Howell and S. D. Burrell.

ARCADE MFG. CO., Freeport, Ill.—Sand blast barrel machines, jolters, air squeezers, jolt squeezers, a core jolter and a pouring device will be shown by this company. The representatives will be L. L. Munn, B. C. Trueblood, Henry Tscherning, Mentor Wheat, Vance S. Firestone, August Christen, G. D. Wolfley, R. E. Turnbull, Herman Kasten and J. A. Morgan.

ARMSTRONG-BLUM CO., Chicago—A metal band saw, an automatic high speed saw, a portable hack saw and punching, shearing and bending machines will be shown by this company. Harry J. Blum will be in charge of the exhibit.

ASBURY GRAPHITE MILLS, Asbury, N. J.—This company will exhibit a line of refined graphite and plumbago including foundry facings, graphite for paint, stove polish, electrical lines and lubricating purposes. Crude graphite for making crucibles also will be shown. The representatives will be H. M. Riddle Jr., Jonathan Bartley and Walter Field.

E. C. ATKINS & CO., Indianapolis—A line of metal cutting equipment consisting of a metal cutting band saw machine, a hack saw machine, circular saws for cutting metal, screw slotting high speed saws, cold saws, foundry plates, hack saw blades and frames. Represented by E. S. Norvell, B. M. Proctor and Lewis Okey.

AUSTIN CO., Cleveland—This company will exhibit photograph models of foundry buildings, drawings of equipment and buildings, including layouts and typical construction details. A new booklet on foundry construction will be distributed. Representatives will be O. D. Conover, G. A. Bryant Jr., H. E. Stitt, A. S. Low, L. R. Campbell and A. H. Meyer.

BACHARACH INDUSTRIAL INSTRUMENT CO., Pittsburgh—This company will show in operation a blast meter and blast recorded for maintaining cupola and air furnace blast, an optical pyrometer for molten metal temperature measurements and CO_2 meter. The representatives will be Edward H. Stehman and L. J. Speidel.

BAKER R. & L. CO., Cleveland—An elevating truck, an electrically driven locomotive crane truck of 3000 pound capacity and 7 foot radius, a charging truck, and a platform with box for handling various commodities, will be shown. Represented by M. A. Watterson, D. L. Darnell, H. B. Greig, W. F. Hebard, T. W. Barnes, A. J. Gates, B. C. Hooper, Charles M. Johnson, Charles F. Zimmerman and Emil C. Held.

BARRETT CRAVENS CO., Chicago—This company, which makes trucks, a portable floor crane, loading platforms, hand trucks and industrial tractors, will be represented.

C. O. BARTLETT & SNOW CO., Cleveland—The exhibit of this comany will consist of photographs of installations of sand handling and mechanical handling equipment in foundries. The representatives will be H. L. McKinnon, H. C. Orr and S. Gertz.

H. L. BAUMGARTNER CORP., Chicago—Various types of cores made with the core oil manufactured by this company will be on display. The company will be represented by H. L. Baumgartner, John Purvis Jr., H. A. Whiting, G. F. Peets, J. B. Skelly, Fred Hamel, and E. Habersank.

BEARDSLEY & PIPER CO., Chicago—A tractor type sand throwing machine will be on display at the booth of this company and motion pictures will be shown of the machine in operation. The representatives will be E. O. Beardsley, W. F. Piper, George Furman, E. L. Mitchell, Mr. Lind, Mr. Schlichter, Mr. O'Connor, Pete Stefan and N. W. Stratford.

BERKSHIRE MFG. CO., Cleveland—The exhibit of this company will consist of jolt squeeze molding machines, air squeeze pattern draw molding machines, jolt squeeze pattern draw molding machines, vibrators, blow cocks, etc. Represented by G. L. Cannon and George A. Scott.

BESLEY, CHAS. H., & CO., Chicago—Ball bearing grinders, vertical spindle wet disk grinders, an abrasive disk with spiral face and a new electric furnace for use with a special cement for setting up abrasive disks will be shown by this company. The representatives will be R. W. Young, C. A. Knill, E. P. Welles, E. L. Beisel, L. E. Jacobs and C. H. Munch.

BETHLEHEM STEEL CO., INC., Bethlehem, Pa.—This company will feature a special brand of pig iron and will show cylinder castings and related work made with this pig iron. The company will be represented by H. B. Kreulen, F. E. Fisher, Robert MacDonald, D. A. Barkely and G. A. Richardson.

S. BIRKENSTEIN & SONS, INC., Chicago

—Die cast ingots, copper, zinc, aluminum and composition metals will be shown. The representatives will be George Birkenstein, Harry Birkenstein, Louis Caviale, Eli Brown, Charles E. Raphael and F. F. Heymann.

BLACK DIAMOND SAW & MACHINE WORKS, Natick, Mass.—A combined band saw filing and setting machine, a circular saw filing machine, a brazing outfit, and band saw guides will be shown by this company. The representatives will be Walter B. Ambler and H. Bromley Ambler.

ALFRED BOX CO., Philadelphia—This company will show a line of cranes for use in the foundry.

BRADLEY WASHFOUNTAIN CO., Milwaukee—Fountain fixtures for the foundry washroom will be displayed by this company. The booth will be in charge of James R. Petley.

BRASS WORLD PUBLISHING CO., New York—

BRIDGEPORT SAFETY EMERY WHEEL CO., Bridgeport, Conn.—This company will exhibit a radial type swing frame grinder and a motor driven floor grinder. The booth will be in charge of E. R. Hyde, D. T. Homan, I. L. Burritt and H. H. Peck.

BUCKEYE PRODUCTS CO, Cincinnati—This company will display foundry core compounds, core oils, parting compounds, refractory cements and miscellaneous foundry specialties. The company will be represented by C. J. Goehringer, E. O. Stamm, C. P. Stamm, C. S. Weigert and R. B. Ferguson.

BURDETT MANUFACTURING CO., Chicago—A safety regulator automatically controling two gasses, a regulator for welding and cutting, and a combination cutting and welding torch will be shown by this company. W. J. White, John G. Glaum, C. P. Clampitt and W. R. Noxon will be in charge

BLYSTONE MFG. CO., Cambridge Springs, Pa.—This exhibit will consist of a core sand and foundry facing sand mixer. The company will be represented by Luther G. Conroe and C. E. McKinney.

CARBORUNDUM CO., Niagara Falls, N. Y.—Carborundum abrasive grinding wheels will be shown together with samples of materials ground on them, such as steel, malleable and gray iron castings from different industries, etc. A moving display of a polishing grain and a cutting off machine equipped with a cutoff wheel also will be shown. Represented by O. C. Dobson, Leonard Pitt, H. E. Kerwin, Anthony Dobson, F. C. Guest, George W. Chormann, Robert Rannie and W. W. Sanderson.

CARTER BLOXONEND FLOORING CO., Cleveland—A large panel made of standard lengths of flooring manufactured by this company will be shown. The panel will be arranged so that it shows the construction of the flooring as well as methods of installing directly over concrete, eliminating embedded sleepers or wood subfloor. The representatives will be A. E. Giese, L. L. Bucklew and W. M. Rynerson.

CARPENTER BROS., Milwaukee—Various foundry sands will be on display at the booth of this company in charge of M. J. Carpenter, W. J. Carpenter and E. N. Carpenter.

FRANK D. CHASE, INC., Chicago—This exhibit will consist of plans and pictures of foundries which have been designed by this firm. Frank D. Chase will be in charge.

CHICAGO CRUCIBLE CO., Chicago—Crucibles, stoppers and other graphite products will be shown by this company. The representatives will be A. F. Hottinger, James P. Foraker, W. Mac Fadden, H. C. Sorenson, J. G. Crowe and Jack Mann.

CHICAGO PNEUMATIC TOOL CO., New York—This company will show a new tandem compound electrically driven compressor with synchronous motor mounted direct to the shaft, together with a line of pumps. Pneumatic tools such as riveting and chipping hammers, air drills, grinders, hoists, bench and floor rammers, etc., also will be on display. The company will be represented by A. R. Goodhue, A. C. Andresen, G. C. Vanden, H. C. Gilligan, J. L. Westenhaver, R. F. Eissler, I. W. McCabe, T. G. Smallwood and D. R. Hughes.

CHISHOLM-MOORE MFG. CO., Cleveland—This company will show a charging machine with charging bucket and magnet, chain hoists, I-beam trolleys, several types of standard chain hoists and an electric hoist. The representatives will be W. H. Morgan, J. R. Mears, F. F. Seaman, W. J. Scott and E. S. Ludlow.

CLARK TRUCTRACTOR CO., Chicago—Gasoline propelled industrial vehicles including an elevating platform truck, an end dump truck and a general utility tractor truck with crane attachment will be exhibited by this company. Richard W. Pears and Walter Nochumson will be in charge of the booth.

CLEVELAND PNEUMATIC TOOL CO., Cleveland—This exhibit will include ball bearing grinders, air drills, sand rammers for floor, pit and bench, chipping hammers, corebreakers, air valves, nipples, hose clamps and air hose couplings. The company will be represented by H. S. Covey, Arthur Scott, J. T. Graves, C. D. Graner, H. C. Newton and R. E. Arern.

CLIPPER BELT LACER CO., Grand Rapids, Mich.—Belt lacers, belt cutters, belt hooks and various sizes of connecting pins as well as electrically operated moving belt display will be shown at this booth. The company will be represented by George E. Farmer and P. E. Crothers.

F. A. COLEMAN CO., Cleveland—This company will have a rolling drawer type core oven in operation. The company will be represented by F. A. Coleman and Swift Miller.

CORN PRODUCTS REFINING CO., New York—This company will make cores demonstrating a core binder which it manufactures and will display cores for various kinds of work. The booth will be in charge of S. B. Krantz, F. G. Faller Jr., H. D. Farris, A. H. Kreischer and D. K. McKinley.

DAILY METAL TRADE, Cleveland—This booth will be fitted up as a rest room where those in attendance at the convention are invited to make their headquarters. The representatives will be John A. Penton, A. O. Backert, J. D. Pease, F. V. Cole, A. L. Klingeman, S. H. Jasper, J. R. Avey and Frank G. Steinebach.

DAVENPORT MACHINE & FOUNDRY CO., Davenport, Ia.—This company will show a jolt rollover pattern draw machine, a jolt stripping machine and a plain jolt machine. Patterns will be mounted on the machines and molds made during the exhibition. The company will be represented by E. J. Byerlein, Carl Falk, A. V. Magnuson, Fred Seemann, Charles Scherer, Harry Schultz and Art Ziebarth.

WM. DEMMLER & BROS., Kewanee, Ill.—This company will have a working exhibit of core machines and will be represented by H. L. Demmler and F. A. Demmler.

DETROIT ELECTRIC FURNACE CO., Detroit—This company will show a 250 pound electric furnace together with a display of other products of its manufacture.

DINGS MAGNETIC SEPARATOR CO., Milwaukee—This company will show photographs of installations and typical magnetic separations. The booth will be in charge of E. S. Hirschberg, M. A. Beltaire, R. L. Johnstone, J. L. Hope and P. A. Meyer.

HENRY DISSTON & SONS, INC., Tacony, Philadelphia—This company will operate a saw machine cutting 4 and 6-inch rounds with a sectional, interlocked, inserted tooth circular metal cutting saw. A metal cutting band saw machine will be used to demonstrate metal cutting band saws.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.—This company will be represented at the exhibition by F. R. Brandon, R. F. Leonard, R. R. Belleville, J. E. Thomas, A. L. Haasis, L. Brower, and E. A. St. John.

DOCK & MILL CO., North Tonawanda, N. Y.—This company will exhibit the different commercial grades of lumber suitable for pattern, flask and templet building. Several sections of a large water cured white pine log also will be shown. The representatives will be Henry Homeyer and Walter M. Nantke.

ELECTRIC FURNACE CO., Salem, Ohio—This company will show photographs of heat treating, annealing and melting furnace installations and will be represented by F. T. Cope, F. J. Peterson, A. J. Vaughan, O. J. Abell and R. F. Benzinger.

ELECTRIC HEATING APPARATUS CO., Newark, N. J.—This company manufactures electric furnaces and will be represented with a booth at the exhibition.

ELECTRIC WELDING MACHINE CO., Detroit—Electric welding equipment will be shown by this company.

ELECTRO REFRACTORIES CORP., Buffalo—This company will exhibit a special crucible and a refractory brick. The representatives will be L. U. Milward, W. E. Howard and Dell Ramsey.

ELWELL-PARKER ELECTRIC CO., Cleveland—A heavy duty lift truck, a heavy type elevator truck, a tractor, a portable crane and an oven furnace charger will be on display at the booth of this company. The representatives will be George W. Brown, Louis R. Millar, J. M. Brown, Cyrus Cole, G. M. Wolff and Mr. Williams.

E. L. ESSLEY MACHINERY CO., Chicago—This company will show radial drills, heavy duty lathes, metal shapers, sensitive radial drills, high speed sensitive drills, snagging grinders, production face grinders, precision surface grinders, universal tool and cutting grinders and twist drill grinders.

EUCLID CRANE & HOIST CO., Euclid, Ohio—A 3-motor traveling crane of about 2 tons capacity and a small capacity 1-motor plain trolley hoist will be exhibited by this company. The representatives will be H. H. Kumler F. H. Hulsman and R. W. Young.

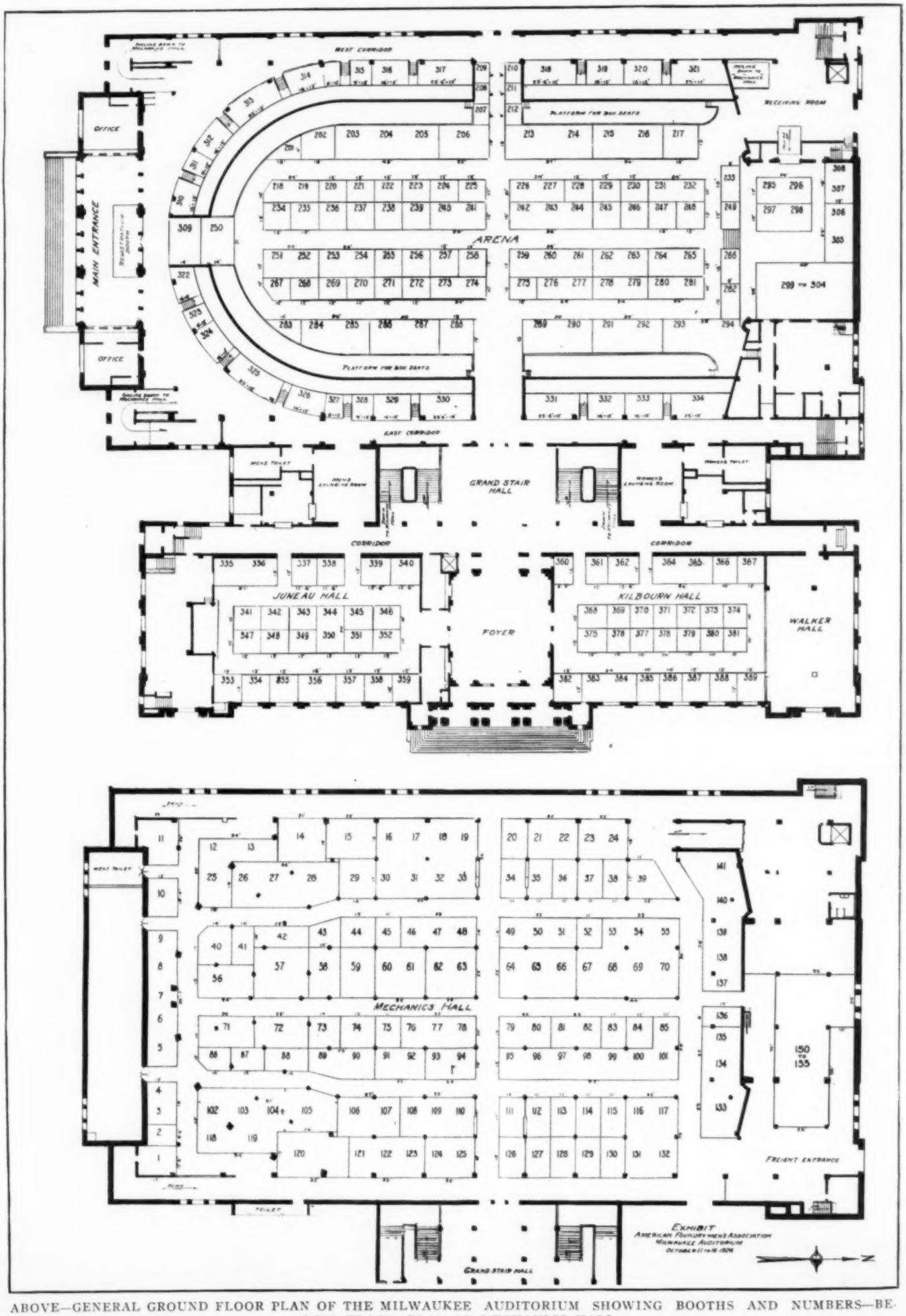
FANNER MFG. CO., Cleveland—This exhibition will consist of a line of foundry chaplets, hard malleable tumbling mill stars, flask trimmings, etc. The company will be represented by J. R. Raible, C. G. Raible, Ed. Durant, F. W. Beck, Pat MacDonnell, C. E. Ireland and John Rayburn.

FEDERAL FOUNDRY SUPPLY CO., Cleveland—The booth of this company will be fitted up as a rest room for the benefit of the guests at the convention.

FEDERAL MALLEABLE CO., West Allis, Wis.—The various details in making molds on machines manufactured by this company will be demonstrated at the booth of this company where the machines will be in operation. L. C. Wilson, W. J. MacNeill, J. P. Wild and K. H. Siemens will be in charge of the exhibit.

THE FOUNDRY, Cleveland—This booth will be fitted up as a rest room where those in attendance at the convention are invited to make their headquarters. The representatives will be John A. Penton, A. O. Backert, J. D. Pease, G. B. Howarth, Dan M. Avey, Pat Dwyer, George A. Drysdale, Frank G. Steinebach, L. C. Pelott, A. L. Klingeman, S. H. Jasper, J. F. Ahrens, F. V. Cole, Fay Crabs and J. J. Kerr.

FOUNDRY EQUIPMENT CO., Cleveland—This company will be represented at the convention by C. A. Barnett, H. W. Steindorf,



ABOVE—GENERAL GROUND FLOOR PLAN OF THE MILWAUKEE AUDITORIUM SHOWING BOOTHS AND NUMBERS—BELOW FLOOR PLAN OF MECHANICS HALL

M. A. Beltaire Jr., E. J. Byerlein and C. M. Holcomb.

J. H. GAUTIER CO., Jersey City, N. J.—Black lead products covering crucibles, retorts phosphorizers, sleeves, stoppers, seats, nozzles, stirrers, feeders, funnels, etc., will be shown at the booth of this company. Also fire brick, fire clay, furnace linings, cupola blocks, gas retorts, etc. will be exhibited. The company will be represented by Oliver W. Bird, Frank J. Connors, George L. Meade, George Fynn, H. Richard Aaron and R. T. Dinwiddie.

GENERAL ELECTRIC CO., Schenectady, N. Y.—This company will be represented at the convention by J. M. Hollister, W. P. Madden, P. A. McTerney, H. E. Spring, C. E. Weeks and C. T. McLaughlin.

GLOBE STEEL ABRASIVE CO., Mansfield, O.—High carbon chilled shot for use in blast cleaning of castings, and a cornered steel grit which is being manufactured in sizes to meet requirements, will be shown at this booth. The display will be in charge of C. H. McConnell.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—Gyratory foundry riddles will be shown at the booth of this company. The exhibit will be in charge of P. L. Wilson.

GRIMES MOLDING MACHINE CO., Detroit—This company will show a power rollover molding machine, a hand rollover molding machine and a small stack molding machine. The representatives will be George L. Grimes, L. V. Grimes and C. J. Skeffington.

R. G. HASKINS CO., Chicago—A line of flexible shaft equipment and assessories will be on display at the booth of this company, which will be in charge of R. G. Haskins.

HAUCK MFG. CO., Brooklyn, N. Y.—Cupola lighters, mold dryers, ladle heaters and a low pressure burner for use on core ovens will be shown by this company. The representatives

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R. J. DOTY
JOHN D. BIRD

will be Willis C. Squire and Herbert Vogelsang.

HAYWARD CO., New York—This company, builders of clam shell, orange peel, draf scraper and electric motor buckets and coal handling machinery, will be represented at the exhibition.

HERMAN PNEUMATIC MACHINE CO., Pittsburgh—This exhibit will consist of a small working model of a large roll over and pattern drawing machine. The representatives will be Thomas Kaveny, A. G. Doyle, Richard Harris, R. F. Ringle, I. J. Oesterling, T. A. Renkenberger, Louis Plassmyer, Alfred Herman, C. W. Miller, R. P. Morgan, R. M. Porteous, C. S. McMath, W. W. Hughes and L. L. Johnston.

HILL & GRIFFITH CO., Cincinnati—This company will maintain a rest room at their booth and will be represented by John Hill, William Oberhelm and Merrill Fox, John H. Lyle, C. L. Gysin and Bruce Hill.

HILLSIDE FLUOR SPAR MINES, Chicago—This exhibit will consist of samples of ore in various grades and stages of concentration and photographs of the mine and mill showing methods and processes of manufacture. The company will be represented by G. H. Jones, Jay L. Hench, M. H. Beatty and R. J. McSherry.

HOLCROFT & CO., Detroit—This company will exhibit photographs, drawings and other technical data on furnaces for melting, annealing and heat treating ferrous and nonferrous metals. New furnaces for the heat treatment of malleable iron also will be shown. The company will be represented by H. L. Ritts, C. T. Holcroft and C. E. Chaney.

ILLINOIS CLAY PRODUCTS CO., Oglesby, Ill.—This company will exhibit a fire clay and will show photographs of plants there the material is in use and also test pieces. Paul G. Bechtner and Otis L. Jones will be in charge.

INDEPENDENT PNEUMATIC TOOL CO., Chicago—Pneumatic drills, chipping hammers, riveting hammers, sand rammers, pneumatic motor hoists, grinders, portable electric drills and grinders, and an electric screw driver for repairing flasks, will be shown by this company. Represented by Adolph Anderson, I. T. Cruice, J. G. Cowell, O. H. Dallman, H. E. Nelson, S. W. Lanham, H. G. Keller, V. W. Robinson, H. F. White, R. S. Cooper and F. W. Buchanan.

INGERSOLL-RAND CO., New York—Pneumatic sand rammers, grinders, chipping hammers, core breakers, motor hoists, drills, riveting hammers, diggers, hose couplings and air compressors will be shown by this company. The representatives will be G. A. Gallinger, L. W. Schnitzer, W. S. Morehouse, C. G. Williams and D. A. Slattery.

INTERNATIONAL MOLDING MACHINE CO., Chicago—This company will show squeezers and combination squeezers, combination jolt stripping machines, combination jolt turnover machines, jarring machines and core making machines. Several of the machines will be in operation. The company will be represented by Edward A. Pridmore, Wm. W. Miller, Carl Levan, E. G. Borgnis, M. J. Monahan, Luke S. Shannon and Hugh Gallagher.

INTERSTATE SAND CO., Zanesville, O.—This company will show samples of molding sand for iron and steel castings and for melting furnace bottoms.

THE IRON AGE, New York—

IRON TRADE REVIEW, Cleveland—This booth will be fitted up as a rest room where those in attendance at the convention are invited to make their headquarters. The representatives will be John A. Penton, A. O. Backert, C. J. Stark, J. D. Pease, E. L. Shaner, H. Cole Estep, L. C. Pelott, J. R. Avey, A. L. Klingeman, S. H. Jasper, F. V. Cole, Fay Crabs and J. J. Kerr.

JOHNSTON & JENNINGS CO., Cleveland—Molding machines of various types including plain air squeezers, jolt squeezers, jolt stripping plate, jolt squeeze pattern draw, jolt squeeze roll over pattern draw, and plain jolt machines will be shown by this company. Vibrators, accessories and hard iron tumbling mill stars also will be exhibited. The company will be represented by T. J. Calhoun, J. L. Battenfeld, R. W. Grammerling and J. W. Reilly.

KAWIN, CHAS. C., CO., Chicago—This company will be represented by Charles C. Kawin, James Jordan, Wm. H. Griner and John Tissing.

KELLER MECHANICAL ENGINEERING CORP., Brooklyn, N. Y.—An automatic die sinker in operation, a universal cutter and radius grinder, a flexible shaft bench grinder, a flexible shaft grinder on roller floor stand, metal patterns, coreboxes, dies, molds, etc., cut on the automatic die sinking machine, and the work produced by these patterns and dies will be shown by this company. S. A. Keller, Jules Dierckx, A. J. Benson and Charles Bitter will be in charge.

WM. H. KELLER, INC., Grand Haven, Mich.—This exhibit will include floor and bench rammers, air operated grinders and drills and riveting and chipping hammers. The company will be represented by James V. Conway, John D. Crowley and Lawrence R. Fedler.

SPENCER KELLOGG & SONS, INC., Buffalo, N. Y.—This company will show core oils and samples of cores. The representatives will be W. L. Goetz, J. N. Yaeger, E. G. Allen, J. B. Catherall, and H. J. Strassberger.

KINDT-COLLINS CO., Cleveland—This company will have on display various pattern shop supplies and one or two pieces of equipment pertaining to pattern shop practice for both wood or metal shops. The company will be represented by V. I. Kimbel and E. T. Kindt.

KING REFRACTORIES CO., INC., Buffalo—This company will show high temperature cements, baffles and fire brick.

KNEFLER-BATES MFG. CO., Indianapolis—Specimens of cores, core binder, castings, technical literature and photographs will be exhibited by this company. The representatives will be Ernest Knefler, George B. Hill, H. J. Bever, John A. Green and M. T. Buck.

CHAS. A. KRAUSE MILLING CO., Milwaukee—This company will exhibit a core binder of its manufacture and will make cores at the booth using the binder. The company will be represented by Fred Rech, S. H. Werner, T. F. Croal Jr., J. V. Baker, and Mr. Collins.

LAKEWOOD ENGINEERING CO., Cleveland—This company will exhibit a truck, tractor, dump body trailer and dump skid. The representatives will be Lion Gardiner, W. A. Meddick, D. E. Van Deusen and G. C. Salisbury.

H. M. LANE CO., Detroit—This company will show photographs and blue prints of work done. H. M. Lane, A. O. Thomas and G. Pitt will be in charge.

LAVA CRUCIBLE CO. OF PITTSBURGH, Pittsburgh—This company will show its regular stock line of crucibles, a new line of refractory shapes including crucible furnace tops, crucible base blocks of pedestals and special shape bricks for lining various types of crucibles. The company will be represented by P. L. Berkey, Furman South, Jr., D. E. MacLean, W. V. Berry and C. E. Peck.

LEEDS & NORTHRUP CO., Philadelphia—A recording instrument designed especially for recording the temperature of malleable iron annealing ovens and an optical instrument used to determine the temperature of molten steel in both open hearth and cupola furnaces, will be displayed by this company. The representatives will be Henry Brewer. C. A. Martin and M. E. Griffith.

LEWIS-SHEPARD CO., Boston—This company will exhibit a lift truck having a spring superstructure and designed especially to handle green sand cores and a stacker with enclosed worm gear drive. Steel leg platforms made from pressed steel also will be shown. The company will be represented by H. B. Shepard, S. A. Meier, and W. K. McMeekin.

LINDSAY-McMILLAN CO., Milwaukee—This company will display core oils, showing samples made with various grades of sand and for different purposes. The representatives will be W. R. Pate, J. A. Gitzen, E. H. Rust and E. W. Carrington.

LINK-BELT CO., Chicago—This company will show a revivifier, an electric hoist in operation and various types of chain together with photographs of installations. A. G. J. Rapp will be in charge of the exhibition.

LOUDEN MACHINERY CO., Fairfield, Ia.—Push and pull cranes, swinging cranes, air hoists, monorail track and trolley systems and other equipment necessary for a handling unit will be displayed by this company. The representatives will be L. F. Berthold, J. P. Lawrence, O. L. Rosenthal, Carl G. Kubaugh, P. I. McCain, L. E. Gaston and E. H. Seelback.

C. E. McARTHUR CO., Chicago—Several sizes of rod and wire straighteners will be shown and a gagger machine will be operated at the booth of this company. A new valve not requiring a stuffing box also will be exhibited. C. E. McArthur, C. L. Stewart and Wm. M. Wilson will be in charge of the exhibit.

J. S. McCORMICK CO., Pittsburgh—This company will exhibit a blacking for washing cores, dry sand and loam work and a binder for pasting and making cores. The company also will have samples at the booth showing work done with their products.

MACLEAN PUBLISHING CO., Toronto, Ont.—

MACLEOD CO., Cincinnati—This exhibit will consist of two sand blast tumbling barrels, a sand blast hose machine, blacking swab sprayers and oil burners. The company will be represented by Walter MacLeod, E. C. Held, James Shields and James Lauder.

MAGNETIC MFG. CO., Milwaukee—This company will show various types of separators. The representatives will be R. H. Stearns, J. P. Bethke, Harold Harman and R. N. Stearns.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—Various types of vibrators manufactured by this company will be on display at this booth. A knock-out vibrator for foundry use will be operated. The representatives will be G. B. Pickop and Frank Bosky.

MARSCHKE MFG. CO., Indianapolis—The exhibit of this company will consist of heavy duty foundry snaggers and grinders, and will be in charge of W. A. Marschke.

MATHEWS CONVEYOR CO., Elwood City, Pa.—A heavy duty ball bearing roller conveyer will be shown by this company. The representatives will be J. H. Hough, H. J. Smith and F. F. Stoll.

MERCURY MFG. CO., Chicago—An internal gear drive electric industrial tractor together with a variety of trailers will be included in the display of this company. Motion pictures will show this method of transportation in actual practice. The company will be represented by A. D. Shanks, H. B. Clapp, Wm. I. Lott, C. W. Henkle, A. G. Leonard Jr., and L. J. Kline.

METAL & THERMIT CORP., New York—This company will show alloys and a welding compound and will be represented by Arthur F. Braid and H. S. Mann.

MICHIGAN SMELTING & REFINING CO., Detroit—This company will show ingot brass, bronze, manganese bronze, phosphor bronze, with photographs and showing structures, a line of babbitt metals and a display of brass forgings. The representatives will be John R.

E. A. ROLPH

T. A. GLASSCOT

DAVID McLAIN

R. S. MacPHERRAN

MRS. F. W. LUENING

MRS. EMIL VILTER

BURTNER FLEEGER

JOHN A. BURKE

JOSEPH C. GRIEB

Searles, Henry Levitt, Norman H. Stillman, R. R. Arnold and Ira S. Erman.

MILWAUKEE CHAPLET CO., Milwaukee—Foundry chaplets, perforated skim gates, perforated tin plate and galvanized foundry riddles will be on display at the booth of this company. The representatives will be Paul F. Rice and J. E. Rice.

MILWAUKEE ELECTRIC CRANE & MFG. CO., Milwaukee—This company will show electric traveling crane parts and will be represented by F. J. Page, C. L. Mayer, A. A. Mayer and George Baumann.

MODERN POURING DEVICE CO., Port Washington, Wis.—This company will show models of its pouring device.

MOLINE IRON WORKS, Moline, Ill.—Stationary and portable hand squeezer molding machines will be included in the exhibit of this company. The representatives will be B. V. Nutt, J. T. Miles and D. E. Miles.

MONARCH ENGINEERING & MFG. CO., Baltimore—A tilting furnace with rocking device, a tilting crucible furnace, a stationary crucible furnace, a stationary iron pot furnace, a stationary or tilting iron foundry cupolette, a combination core oven, a sand mixer, a positive pressure blower and motor with oil pump, a bottom pour white metal furnace, etc., will be shown by this company. The representatives will be George Schimpt, Harry D. Harvey, James V. Martin, Frank Maujean, William Raber and Wm. Chenowith.

NATIONAL ENGINEERING CO., Chicago—A sand mixer arranged for direct motor drive will be in operation at the booth of this company mixing various sands. The largest diameter mixer made by this company also will be shown as well as a sand machine for aerating and screening foundry sand. The company will be represented by H. S. Simpson, C. D. Hollins, B. Castor, H. N. Schreuder, C. J. Skeffington and G. C. Richards.

NEW HAVEN SAND BLAST CO., New Haven, Conn.—This company, which makes sand-blast equipment, will have display at the exhibition.

WM. H. NICHOLLS CO., INC., Brooklyn, N. Y.—Ten sizes and types of molding machines, which include plain jolt machines, jolt squeezers, jolt squeeze and stripping machines and magnetic drawing machines, will be on display at the booth of this company. The representatives will be Wm. H. Nicholls, Geo. E. Karl, H. P. Mackinnon.

NORTHERN BLOWER CO., Cleveland—This company will show sand blast rooms, filters, dust arrester equipment and core and mold ovens. Demonstration models of the machines will be on display. The company will be represented by M. A. Eiben, L. L. Eiben, Charles Weger, C. H. Uthe and J. J. Gedeon.

NORMA-HOFFMAN BEARINGS CORP.—Long Island City, N. Y.—Precision ball bearings, precision thrust bearings, measuring instruments and roller journal bearings will be included in the products of this company which will be on display. The exhibit will be in charge of T. J. Harley and Robert Gannett.

NORTON CO., Worcester, Mass.—This exhibit will consist of a table display of grinding wheels, floor stands, refractory ware and floors and will be in charge of H. W. Dunbar, W. R. Moore, Herbert Duckworth, G. W. Thomson and H. K. Clark.

S. OBERMAYER CO., Chicago—This company is plannnig its exhibit for its golden anniversary and will show a new plastic blacking for foundries and a sand pin. Theo. Kauffman, S. T. Johnston, J. L. Cummings, J. J. McDevitt, W. R. Tanner, J. E. Evans, O. J. Peterson, O. C. Olson, A. W. Wallin, O. W. Josephson, F. B. Flynn, W. R. Cummings and H. D. Baker.

OILESS CORE BINDER CO., Cleveland—Core binder and a number of castings made in connection with this binder will be on exhibition at this booth. The representatives will be J. A. Hamilton, H. P. Fischer and H. A. Baker.

GEORGE OLDHAM & SON, Baltimore—This company will show chipping hammers, foundry rammers, scalers and riveters. The booth will be in charge of C. H. Lyle, H. J. Bannister and R. W. Nelson.

OLIVER MACHINERY CO., Grand Rapids, Mich.—This company will have an operating demonstration of pattern working machines and pattern shop equipment, the machines being of the beltless type with built in motors. Included in the machines to be shown will be saws, planers jointers, sanders, lathes, band saw brazers, etc. The company will be represented by Armen S. Kurkjian, G. C. Conklin, J. E. McLauchlen, Wm. G. Tice, and G. C. Ramer.

OSBORN MFG. CO., Cleveland—The exhibit of this company will consist of a jolt rollover pattern drawing machine, air operated portable squeezer machine, jolt and squeeze stripper molding machine, jolt rollover pattern draw machine, jolt stripper machine, jolt rollover squeeze pattern draw machine and an air operated jolt squeeze machine. The representatives will be F. G. Smith, E. S. Carman, M. W. Zeman, E. T. Doddridge, J. C. Alberts, F. T. Spikerman, R. E. Kiefer, M. R. Atwater, J. F. Howard, J. D. Wise, R. W. Hisey, E. F. Oyster and Ward Dougherty.

OXWELD ACETYLENE CO., Chicago—A line of oxyacetylene welding and cutting equipment, oxygen, acetylene and carbide will be shown. The company will demonstrate some of the welding processes and will show motion pictures on welding and cutting.

PANGBORN CORP., Hagerstown, Md.—This company will show sand blast equipment in operation cleaning castings, as well as dust arrester equipment and steel abrasives. Interesting castings from various foundries also will be shown. Thomas W. Pangborn, John C. Pangborn, H. D. Gates, P. J. Potter, F. J. Hull, George A. Cooley, Jesse J. Bowan, Wm. T. Randall, Chas. T. Bird and W. C. Lytle will represent the company.

PATENT CEREALS CO., Geneva, N. Y.—A core and facing binder will be on display and cores, sample of core mixtures, pictures of large castings made with this binder, etc., will be shown. The exhibit will be in charge of A. N. Duncan and T. K. Fahy.

PAWLING & HARNISCHFEGER CO., Milwaukee—This company will furnish a 5-ton crane for the model foundry to be erected at the show and will equip the crane with a single line bucket. At the booth of the company a small monorail hoist will be shown.

J. W. PAXSON CO., Philadelphia—This company will show blue prints, models, etc., of the foundry equipment of its manufacture. The booth will be in charge of H. M. Bougher, I. V. Kremer, L. B. Passmore and Harry Titgen.

PENTON PUBLISHING CO., Cleveland—This booth will be fitted up as a rest room where those in attendance at the convention are invited to make their headquarters. The representatives will be John A. Penton, A. O. Backert, C. J. Stark, H. Cole Estep, J. D. Pease and F. V. Cole.

PETERSON CORE OIL & MFG. CO., Chicago—This company makes core oil and will maintain a display booth at the exhibition.

PICKANDS, BROWN & CO., Chicago—This company will exhibit foundry coke and will be represented by G. A. T. Long and C. M. Pearson.

PITTSBURGH ELECTRIC FURNACE CORP., Pittsburgh—Pictures of its electric furnace will be shown by this company and castings of iron and steel made by firms using the furnace will be exhibited. The company will be represented by W. B. Wallis, W. E. Moore, R. S. Kerns, H. E. Bromer, Alexander Haigh, O. J. Abell, Presley Hamilton, M. A. Beltaire and H. A. Morton.

W. H. PITKORN CO., Milwaukee—This exhibit will consist of high temperature cements made by the Quigley Furnace Specialties Co., Inc., cupola linings, side wall brick, malleable bungs, annealing ovens, ladle linings and plastic fire clay. The representatives will be J. A. Davidson, W. G. Meyer, W. H. Gaylord, Mr. Adams and Mr. Gilbert.

PORCELAIN ENAMEL & MFG. CO., Baltimore—This company will have the booth fitted up to entertain visitors at the convention.

PORTAGE SILICA CO. Youngstown, O.—Samples of various grades of steel molding, core and sand blast sands and samples of conglomerate silica rock in its natural state will be shown at the booth of this company. The representatives will be E. E. Klooz, C. F. Eberhart and L. R. Farrell.

HENRY E. PRIDMORE, INC., Chicago—This company will display a combination jolt squeeze machine, a combination air jolt power strip machine, a combination air jolt power rock over, foot draw machine, a square stand machine and a core machine. The company will be represented by E. M. Pridmore, Henry A. Pridmore, Henry Burggraf, Earl B. Pridmore, Frank W. Hamel, Marshall E. Pridmore, D. F. Eagan, George Fuller, W. Fenton, M. A. Bell and Harry Rautenbach.

QUIGLEY FURNACE SPECIALTIES CO., INC., New York—This company will have a joint exhibit with the W. H. Pipkorn Co., Milwaukee, and will show high temperature cements for bonding refractory materials, which may be used for furnace linings, cupolas, foundry ladles, etc.; a refractory ganister for rammed in linings; and a new ganister for lining pit furnaces, etc. The company will be represented by W. S. Quigley, W. H. Gaylord and D. F. McMahon.

RACINE TOOL & MACHINE CO., Racine, Wis.—High speed metal cutting machines, various models of a band saw machine and a special foundry cutting machine will be shown at the booth of this company. The representatives will be J. M. Jones, Wm. C. Reinhardt and A. B. Carmen.

READING CHAIN BLOCK CORP., Reading, Pa.—A one ton electric hoist operating an elevator and a single drum electric hoist for use in connection with a tramrail system will be shown by this company. The firm will be represented by Fred A. Howard and F. H. Howard.

REPUBLIC CARBON CO., Milwaukee—The booth of this company will be fitted as a rest room. The company will be represented by F. E. Clark, A. F. Preuster, W. G. Berlin, F. R. Kemmer and R. L. Baldwin.

RICHARDS-WILCOX MFG. CO., Aurora, Ill.—This display will consist of I-beam ball bearing trolleys for handling loads up to four tons, and a line of monorail and trolley track equipment incuding switches, curves, turntables, etc. The representatives will be W. H. Fitch, P. L. Hoffman, E. J. G. Phillips, A. J. Eggleston, C. Riemenschneider, A. J. LaFleur and A. W. Thurow.

ROBESON PROCESS CO., New York—This exhibit will consist of apparatus for demonstrating binders, cores of various shapes will be shown and literature will be distributed. The representatives will be G. I. Lindsay, S. T. Adair, T. J. Ryan, T. J. O'Hara, J. A. Smith and B. W. Bullen.

ROGERS, BROWN & CO., Cincinnati—This company will display iron castings in which its charcoal iron is used, as well as samples of aluminum, brass, sand coke and other commodities. The representatives will be F. W. Bauer, J. C. Mears, A. B. Weaver,

JULIUS LIEBMAN
HENRY R. DONALD
R. P. TELL
MRS. R. A. NOURSE
W. J. FAIRBAIRN
MRS. ROBERT L. BALDWIN
A. J. DROLSHAGEN
A. W. GREGG
A. J. LINDEMAN

E. A. Rudolf, C. E. Trommer, L. W. Hoefinghoff, W. E. Oelschlaeger, A. M. Barker, Harwood Wilson, Thomas A. Wilson, George R. Sullivan, R. B. Melville, A. F. Stengel, F. E. Fitts, J. A. Claussen, A. J. Wentworth, J. R. Morehead.

P. H. & F. M. ROOTS CO., Connersville, Ind.—This company will operate a cupola charging hoist equipped with a charging bucket as well as a lifting magnet. In addition to the hoist the line of foundry equipment of its manufacture will be shown. The representatives will be H. M. Papworth, D. R. Schively, W. L. Sexton, Louis Oakley and Edmund L. Hiatt.

ROSS-TACONY CRUCIBLE CO., Philadelphia—This company will show graphite crucibles for melting steel and nonferrous metals, graphite stopper heads for bottom pour ladles, graphite nozzles, sleeves, special shapes, etc. The representatives will be Charles C. Bacon, C. S. Orne Jr. and I. R. Robinson.

ROYER FOUNDRY & MACHINE CO., Kingston Station, Wilkesbarre, Pa.—This company will show various models of its sand separator and blending machine and also a sand mixing plant in operation. The representatives will be G. F. Royer, John Lloyd, Mr. Cosgro, Mr. Haigh and Mr. Baxter.

RUEMELIN MFG. CO., Minneapolis, Minn.—This exhibit will consist of a square sand blast cabinet, small portable sand blast guns and helmets, a sand blast generator of the high pressure type, a sand blast sifter, exhaust motor fans and a pipe adapter nozzle for high pressure sand blasts. The display will include a working model of a dust arrester.

SAFETY EQUIPMENT SERVICE CO., Cleveland—Asbestos gloves, clothing and leggings, goggles for chippers, welders, etc., guards for machines and other safety equipment will be on display at the booth of this company.

SAFETY FIRST SHOE CO., Boston—This company will show a line of special shoes made for foundry workers. The booth will be in charge of Edgar C. Davidson.

SHEPARD ELECTRIC CRANE & HOIST Co., Montour Falls, N. Y.—A charging bucket for pig iron, a charging bucket for coke and scrap, a bottom dump charging bucket, a cupola charging hoist, a floor operated cupola charging hoist, a one ton crane for drawing patterns from molds and setting cores and a 500 pound electric hoist will be shown. The representatives will be F. A. Hatch, R. H. McGredy, W. L. Briggs and G. L. Drake.

SKEPPSTEDT-ERICKSON CO., Moline, Ill.—This company will operate two types of core machines and will show sample cores and castings that have been made with cores made n these machines. Samples of castings, that for economical reasons have been redesigned, will be shown. The representatives will be E. G. Erickson and O. Skeppstedt.

SKYBRITE CO., Cleveland—This company will demonstrate its glass cleaner being applied to dirty glass removed from various foundries throughout the country. The company will be represented by T. T. Holt, J. N. Gordon, B. T. Sherk and E. W. Bayless.

W. W. SLY MFG. CO., Cleveland—A sand-blast room, sand-blast cabinet, sand-blast mill, tumbling mill equipment, dust arrester equipment and special parts will be shown by this company. The representatives will be S. C. Vessy, F. W. Klatt, F. A. Ebeling, G. A. Boesger, D. P. Carter, L. B. Brewster, H. C. Nicholas, R. W. Hasselle, C. P. Guion, R. O. Mullen and W. L. Kammerer.

SMITH OIL & REFINING CO., Rockford, Ill.—This company will exhibit its core oil together with samples of cores. Omer Smith and A. Abramson will be in charge of the booth.

WERNER G. SMITH CO., Cleveland—Samples of core oils and specimen cores made with its oils will be shown by this company. The representatives will be Werner G. Smith Frank H. Dodge, L. P. Robinson, Milton S. Finley, William E. Rayel, Wallace Alexander, John Glass, M. M. Werckman, Geo. J. Graham, E. H. Heartlein, Charles Ellis and Louis F. Ferster.

SPENCER TURBINE CO., Hartford, Conn.—Compressors for supplying air for foundry cupolas and for oil and gas burning furnaces, all of which are electrically driven, will be exhibited by this company. H. M. Grossman and O. J. Dingee will be in charge.

STANDARD HORSE NAIL CO., New Brighton, Pa.—This company will exhibit special foundry nails and will be represented by R. C. Hutchings.

STANDARD RADIAL BLAST CORP., New York—This company will show a sand blast barrel, motor driven, on which a number of improvements have been made. The representatives will be Charles S. Johnson and John R. Sheldon.

STEEL PRODUCTS MFG. CO., Cicero, Ill.—This company makes screw machine products and drive chains and will be represented at the exhibition.

STERLING WHEELBARROW CO., West Allis, Wis.—This company will display flasks and wheelbarrows. The representatives will be George L. Lambkin, L. E. Washer, H. J. Felsburg, C. L. Kirk, J. M. Dickson, J. J. Coyne, Leo Hartwell, Otto Steep, R. F. Jordan, A E. Welch and H. H. Baker.

FREDERIC B. STEVENS, INC., Detroit—This booth will be fitted as a rest room. The company will be represented by Frederic B. Stevens, W. J. Cluff, J. M. Mayers, Jas. F. Hughes, J. M. Johnston, Daniel Campbell, W. H. Dee, T. H. Ledden, Hal S. Taylor and Ward Dean.

STONEY FOUNDRY ENGINEERING & EQUIPMENT CO., Cleveland—This company expects to have a new type of molding machine in operation at its booth. A knockout machine, a shakeout bail and a large vibrator will be exhibited and photographs will show the type of engineering work done. The representatives will be John T. Stoney, Raymond E. Stoney, E. S. Cohen, L. J. Reinhard and George Gage.

N. A. STRAND & CO., Chicago—This company expects to have on display all of its types of machines and equipments and will be represented by C. W. Blakeslee and N. A. Strand.

SULLIVAN MACHINERY CO., Chicago—This company will have a compound air compressor in operation furnishing air for other exhibitors. It also will show a straight line belt driven air compressor and two types of portable drum hoist, one operated by compressed air. The exhibit will be in charge of Joseph H. Brown and E. W. Noyes.

SWARTWOUT CO., Cleveland—An electric steel insulated core oven will be exhibited by this company. The representatives will be Carl F. Mayer, G. S. Montgomery and N. P. Sanborn.

WILLIAM SWINDELL & BROS., Pittsburgh—This company will install a 1000-pound electric melting furnace and complete switchboard equipment, automatic control electrode mechanism, mast equipment, etc. The representatives will be E. H. Swindell, R. W. Porter, F. W. Brooke, W. H. Cosgrove, J. F. Baker, H. C. Bement and E. A. Hanff.

TABOR MFG. CO., Philadelphia—Jarring machines, both plain and shockless; jar roll over machines, both plain and shockless; plain squeezers, jar squeezers, jarring stripping plate machines, etc., will be on display. The representatives will be Wilfred Lewis, J. T. Ramsden, H. W. Brown, Jas. H. Coleman, E. Sidney Lewis, H. W. Impey, Wm. E. Sewell, T. L. Sumner, John Pfendner and P. J. Shire.

THOMAS ELEVATOR CO., Chicago—This company will show hoists applicable to the foundry industry.

TRUSCON STEEL CO., Youngstown, O.—In addition to the regular exhibit of flasks and equipment, this company will show building materials, standard steel buildings, steel windows, and concrete reinforcing of all kinds. The representatives will be G. F. Sparks, N. C. Ferreti, G. E. Snedecker, J. C. Peirce, H. W. Jencks, G. E. Madden and I. S. Leland.

UNITED COMPOUND CO., Buffalo—Vent wax, pattern wax and corrugated gaggers will be shown by this company. John W. Bradley, Wm. F. Bradley and L. F. Leney will be in charge of the booth.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Plumbago and foundry facings as well as other products for the foundry will be exhibited by this company. The exhibit will be in charge of J. G. Drought.

UNITED STATES SILICA CO., Chicago—This company will show its sand blast abrasive and samples of cleaning work in which this abrasive was used. It also will exhibit a flow meter set up to illustrate the method of connecting with sand-blast equipment, together with fittings and blue prints showing the method of connecting to air lines of various sizes. The representatives will be Volney Foster, H. F. Goebig, Fred Paul and O. M. Olsen.

VIBRATING MACHINERY CO., Chicago—This company will exhibit an electric sand sifter and be represented by Julius Schroeter.

WALDO, EGBERT & McCLAIN, INC., Buffalo—Foundry, malleable, basic, high manganese, charcoal, high silicon, low phosphorus and high phosphorus pig iron, foundry coke coal, galvanized sheets and various grades of fuel oil will be shown by this company. The representatives will be Fred J. Waldo, Justus Egbert, Michael F. Selbert and Loring G. Calkins.

J. D. WALLACE & CO., Chicago—A line of machines including a bench band saw, universal saw, plain saw, jointer, planer, lathe, glue pot and solder pot will be on display at the booth of this company. The representatives will be J. D. Wallace, H. L. Ramsay, C. D. Grey and S. N. Brickhouse.

THE WARNER & SWASEY CO., Cleveland—This company manufactures a line of turret lathes and will be represented at the convention.

WATSON ENGINEERING CO., New York—This exhibit will consist of photographs, transparencies, pamphlets and other matter covering the field of operation of this company. The company will be represented by R. A. Spengler.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh.—This company will exhibit an arc welding set in operation and a new type of motor for foundry use together with an automatic starter and safety switch. A new sealed sleeve bearing motor will be on display. In addition an electric glue pot, and electric space heater will be shown. Representatives are C. D. Pence, M. E. Mann, Phelan M. Shaw, J. C. Barley and R. R. Davis.

WESTINGHOUSE TRACTION BRAKE CO., Wilmerding, Pa.—A motor driven air compressor with automatic control, a main reservoir, several types of air operating valves suitable for both single and double acting cylinders, air cutout cocks, air hose and fittings, etc., will be exhibited by this company. The representatives will be M. H. Burchard, F. C. Young, R. G. Justus, S. A. King, O. H. Miller, S. B. Schrontz, J. F. Ames and P. L. Bradford.

WHITING CORP., Harvey, Ill.—A steel tube air hoist, tumbling mill with clutch and brake, helical worm geared crane ladle, air

E. P. RUETER
JULIUS HEIL
GEORGE KUEMMERLEIN JR.
MRS. ALBERT HARRISON
RAY SMITH
WALTER KASTEN
MAX W. BABB
JOHN A. MONAHAN
JOHN M. THOMAS
CHARLES DUNLOP

operated foundry bucket, solenoid brake and foot brake for crane, together with a model of a crane, trolley, blue prints, photographs, etc. will be exhibited by this company. The representatives will be J. H. Whiting, R. H. Bourne, A. H. McDougall, G. P. Fisher, R. E. Prussing, J. S. Townsend and R. E. Ludwick. The Grindel Fuel Equipment Co., will exhibit pulverized coal feeding and firing equipment at the same booth. This company will be represented by A. J. Grindle, R. H. Bourne and M. F. Becker.

G. H. WILLIAMS CO., Erie, Pa.—This company will exhibit a single line clam shell bucket and will have a working model operating with a model derrick and run by electricity. The company will be represented by C. D. Buoy, T. D. Harter and H. F. Randall.

E. J. WOODISON CO., Detroit—This company will exhibit a core blowing machine for making cores. The company will be represented by E. J. Woodison, C. H. Woodison, J. C. Woodison, C. D. Yahne, G. A. Burman, A. W. Ferguson, J. M. Witters, C. H. Witters and J. W. Taylor.

YOUNG BROTHERS CO., Detroit.—A new conveyor oven unit, a working model of a conveyor type core oven installation and a laboratory oven in operation will be shown by this company. The representatives will be R. B. Reed, V. A. Fox, T. P. McVicker, H. M. White, C. G. Lisch and P. A. Meyer.

Plan Interesting Social Features

(*Concluded from Page 761*)

portunities for plant visitation. Many of the larger and better known plants where interesting process are employed will be open for inspection and visitation during the convention. Information on the plants will be furnished at the booth in the Auditorium.

Special entertainment has been provided for the ladies attending the convention which will bridge the time alloted to the technical sessions. On Tuesday morning, Oct. 14, the ladies will be taken for an automobile ride through the lake district and luncheon will be served at the Hotel Majestic, Oconomowoc, Wis. The state is noted for its beautiful lakes, and those around Milwaukee are well worth seeing. After luncheon the ladies will be afforded an opportunity to inspect one of the plants of the Carnation Milk Co., a model plant where condensing, evaporating, etc., are carried out. The visitors will be returned to the hotel in sufficient time to rest before the entertainment of the evening.

Wednesday morning, Oct. 15, will be occupied with a motor trip through certain parts of the city and outlying districts. The motor trip will be divided by a luncheon at the Eline Chocolate plant. The ladies will be given an opportunity of inspecting this plant.

A transportation booth will be installed in the Auditorium and will be in charge of railroad representatives. The men at this booth will arrange transportation for departing guests and will render all possible assistance in caring for transportation.

Special rates have been granted for the convention. Those attending are requested to obtain certificates when buying their transportation to Milwaukee. These certificates will be validated by officials of the American Foundrymen's association and on presentation at the ticket offices in Milwaukee will entitle the holders to a half fare rate on the return journey.

Electrochemists To Meet in Detroit

Much interest is being expressed in the convention of the American Electrochemical society to be held at the Hotel Tuller, Detroit, Oct. 2-4. The subjects covered by the technical program have a wide commercial bearing. The morning and afternoon session of the first day will be devoted to a symposium on "Corrision," a subject of interest not only to electrochemists but to engineers in every field of activity. Contributions to this subject have been received from all parts of the world.

Since Detroit is the center of the automobile industry in this country, it is fitting that the society conduct an open forum on "Industrial Electric Heating," in which the automobile industry has made such remarkable strides. Prof. C. F. Hirshfled, the Detroit Edison Co., is responsible for the program on electric heating. There also will be sessions on "Refractories for Electric Furnaces" and the "Physical Chemistry of Electrodeposition."

Two round table discussions have been arranged, one on "Electric Furnace Cast Iron" in charge of G. K. Elloitt, the Lunkenheimer Co., Cincinnati, and the other on "Control Methods in Electrodeposition" in charge of Prof. O. P. Watts, University of Wisconsin and Dr. Wm. Blum, United States bureau of standards. Alex Dow, president of the Detroit Edison Co., will address the meeting Friday evening on "Central Station Design and Superpower." Industrial plants will be visited and social entertainment will be provided for the visitors.

Joins Eastern Firm

R. L. Mann, formerly with the Tate-Jones Co., Pittsburgh, now is connected with the Combustion Engineering Corp., New York, in the furnace department. Axel Ventz, Inglstad, Sweden, also is connected with the Combustion Engineering Corp. in the same department.

Book Review

Penton's Foundry List, 1925; cloth, 620 pages, 4 x 6½ inches; published by the Penton Publishing Co., Cleveland and may be secured from the company direct or through THE FOUNDRY for $25 net.

This is the latest revised edition of a book that first was issued over twenty years ago and which has been rechecked, revised and issued at 2-year periods since that time. With greater and more extended sources of information to draw from on each succeeding occasion it is only reasonable to assume that the present edition is more complete and accurate in every detail than any of its predecessors. In addition to the material presented in former editions, the present volume has been amplified to the extent of including information of a vital character never before available in printed or collected form. Amplified data are included showing the potential capacity of each foundry. This information has been tabulated in brief form so that the reader, at a glance, may ascertain the number, class and capacity of the various melting units in the majority of the foundries listed. Obviously the character of an establishment, its relative size and many other features may be judged from its melting equipment more satisfactorily than from any other single factor connected with its operation. The number of employes, output over a period of years and other variable elements differ so widely from time to time and from various causes that they do not constitute a reliable index.

Data on the melting units is presented in the first section of the book containing the combined listings of the gray iron, steel, malleable and nonferrous casting plants. A simple key facing page 1 and designed on the simplest possible system for supplying quick information presents the statistics on furnaces and capacities.

The book is compiled in four sections with each section printed on different colored paper to facilitate ready reference. The first section on white paper carries a complete listing of *all* foundries. The second section on yellow paper presents a list of the nonferrous foundries. The steel foundries are listed on blue paper and the malleable foundries are shown on pink paper.

Firms operating machine shops and patternshops are designated throughout the book. Individual nonferrous foundries are listed by themselves to distinguish them from nonferrous casting departments of a general plant. Electric steel casting plants also are listed separately from others under the general steel foundry section.

Makes Heavy Turbine Casing

Detailed Description Is Presented of the Molding Methods Employed in Producing a 15,000 Kilowatt Turbine Casing, Bottom Half, Exhaust End, in a Prominent English Foundry

BY J. SHAW

VARIOUS steps in the preparation of the mold for a casting weighing approximately 50,000 pounds and presenting an average metal thickness of 1¾ inches recently made by the Brightside Foundry & Engineering Co., Ltd., Sheffield, England, are shown in the accompanying illustrations. The casting was molded from a skeleton pattern in the opposite position from that shown in Fig. 1. All the large cores were formed directly in the pattern and were built up at the same time as the outer part of the mold. Small cores made in separate coreboxes and placed in the mold before it was assembled include the port core over the diaphragm seat, deflector core, thermometer box core, bearing core windows in the feet, pipe openings, bolt lug cores, oil box core and several other smaller cores at various points.

The casting was molded in a pit 9 feet deep, provided with a bottom plate that weighed 18 tons. This bottom plate served as a level foundation on which to erect the mold and also served as an anchor to which the upright binders were attached. The binder bars served also as standards extending from the bottom plate to the joint surface of the mold on which the cope flask rested. A steel ring or loop in the upper end of each binder furnished a ready means for attaching short hook bolts to hold the cope in place after the mold was assembled.

Two courses of brick were built on the bottom plate, after which a thickness of loam was swept to form a level bed the approximate area of a templet corresponding to the shape of the outside of the desired casting. The various sections of the pattern were assembled on this bed in their proper position relative to each other. An iron plate provided with suitable lifting hooks was placed in the diaphragm seat opening and a core of bricks and loam was built up to the proper point on the pattern. Several gratings, designed to bind the core closely together were built into the core about 18 inches apart as the work progressed. The interior of the core was filled with cinders and the vent was taken through an opening provided for the purpose in the back of the mold. The corresponding opening in the end of the core may be noted in Fig. 3. A vertical joint was made at both ends of the core. The surface of the core then was struck off to size, after which the thickness corresponding to the thickness of metal was built on and the parting was made over the remainder of the surface.

The diaphragm side of the mold, Fig. 5, was rammed with dry sand to the top flange joint. The sand was reinforced at each course by a row of short rods laid horizontally. The two ends of the mold were then rammed in like manner. A parting was made over the inside surface of the pattern at the feet.

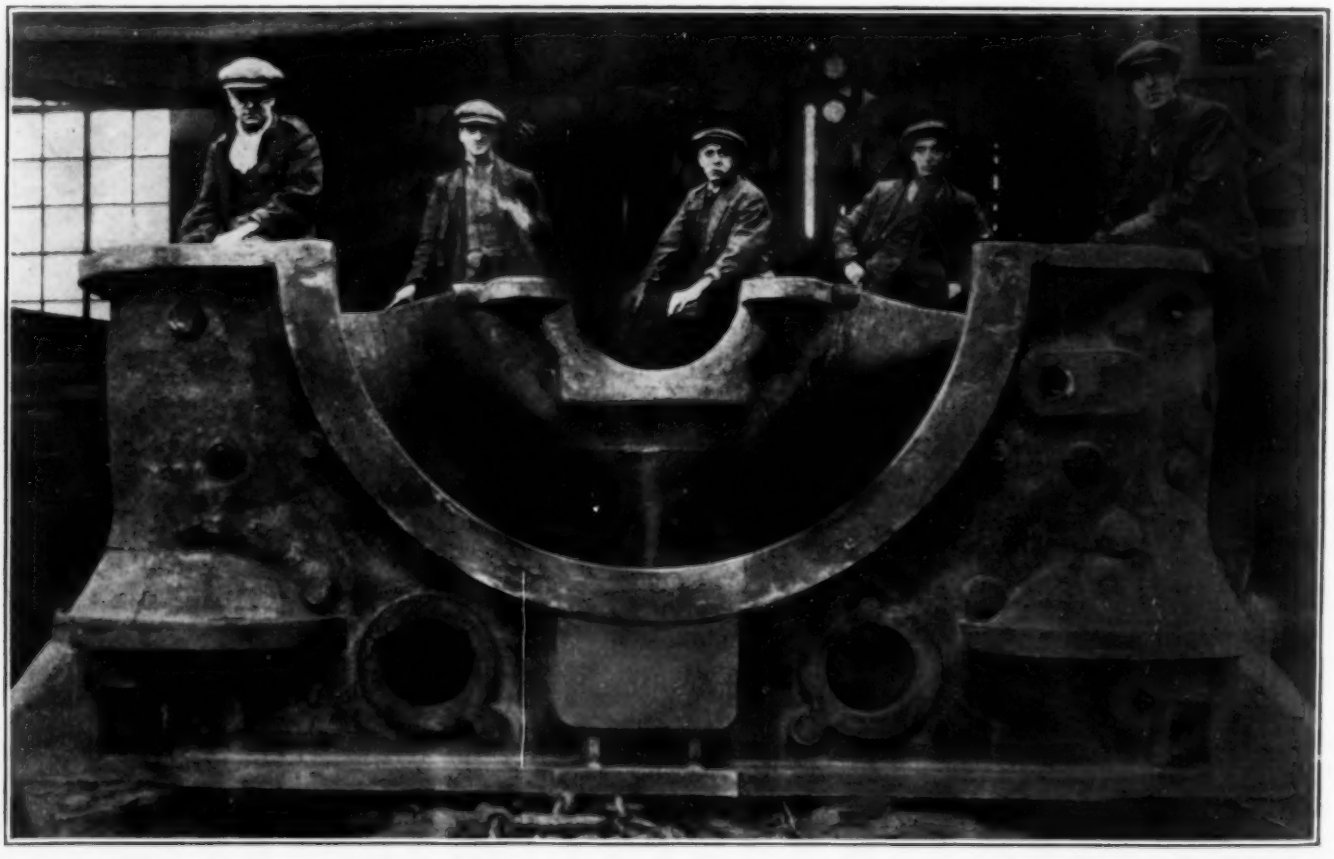

FIG. 1—LOWER HALF OF 15,000 KILOWATT TURBINE CASING WAS MOLDED FROM A SKELETON PATTERN WHICH SERVED TO FORM BOTH THE INSIDE AND OUTSIDE OF THE MOLD—THE CASTING WAS MOLDED AND POURED IN THE OPPOSITE POSITION FROM THAT SHOWN IN THE ILLUSTRATION

Cut to this point

TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

Commodity	Name Symbol	Silica SiO_2	Ferrous Oxide Fe O	Ferric Oxide Fe_2O_3	Alumina Al_2O_3	Calcium Oxide Ca O	Magnesium Oxide Mg O	Sulphur S	Loss	Water H_2O	Alkali	Volatile Matter	Source of Data	
REFRACTORIES—(Continued)														**REFRACTORIES—(Continued)**
Lining Materials														**Lining Materials**
Magnesite—Calcined—Dried		4.45	.....	7.78	1.52	4.45	80.24	.....	1.56	.....	.....	.....	Illinois Steel Co., Gary, Ind.	1913
Magnesite—Calcined		4.30	.....	4.95	0.85	4.10	84.45	.....	.....	.....	.....	1.35	American Refs. Co. Product, Illinois Steel Co., Chicago	1909
Magnesite—Calcined		3.40	.....	6.35	1.00	6.50	80.90	.....	.....	.....	.....	1.85	General Refs. Co. Product, Illinois Steel Co., Chicago	1909
Magnesite—Calcined		1.80	.....	6.55	1.00	8.20	84.75	.....	.....	.....	.....	2.90	Harbinson & Walker Refs. Co. Product, Illinois Steel Co., Chicago	1909
Magnesite—Calcined		2.80	.....	8.23	0.92	0.25	87.30	.....	0.22	.....	.....	.....	Geo. B. Blackwell & Co., Ltd., Liverpool, England	1915
Magnesite—Cement		6.70	.....	3.96	0.94	2.45	85.31	.....	0.42	.....	.....	.....	Geo. B. Blackwell & Co., Ltd., Liverpool, England	1915
Magnesite—California Calcined		0.17	.....	0.32	1.90	2.05	87.56	.....	.....	8.00	.....	.....	General Electric Co., Pittsfield, Mass.	1921
Magnesite—Electric Calcined		1.20	.....	0.40	0.10	2.93	95.28	.....	.....	0.00	.....	.....	General Electric Co., Pittsfield, Mass.	1921
Magnesite—Raw		3.68	.....	1.40		10.51	36.26	.....	.....	.....	.....	.....	McLain's System, Milwaukee	1919
Mica Schist		96.25	.....	2.70	0.70	0.10	0.10	.....	.....	.....	.....	0.10	Edge Hill Silica Rock Co., Product, Illinois Steel Co., Chicago	1909
Sand—Furnace Bottom		97.25	.....	0.16		0.08	0.39	.....	0.36	0.24	0.36	.....	Harbinson & Walker Refractories Co., Pittsburgh	1916
Sand—Furnace Bottom		90.30	.....	2.20	3.40	1.70	0.60	.....	.....	.....	.....	1.65	Geo. Castle Co. Product, Illinois Steel Co., Chicago	1909
Sand—Furnace Bottom		97.08	.....	0.57	1.12	0.21	0.20	.....	0.82	.....	.....	.....	Wilgen Sand Co. Product, Illinois Steel Co., Gary, Ind.	1914
Sand—Furnace Bottom		94.41	.....	1.30	3.15	0.04	0.13	.....	1.10	.....	.....	.....	Foxburg Sand Co. Product, Illinois Steel Co., Gary, Ind.	1914
		Zirconium Oxide ZiO_2	Silica SiO_2	Ferrous Oxide Fe O	Titanium Oxide TiO_2	Alumina Al_2O_3								
Zirconium Oxide		99.91	0.02	0.01	0.04	0.01	.....	.....	.....	.....	.....	.....	Foote Mineral Co., Philadelphia	1921
		80.00	10.00	1.00	.....	.....	.....	.....						
Zirconium Oxide (Zirkite)		85.00	15.00	2.00					.....	.....	.....	.....	Foote Mineral Co., Philadelphia	1921
		70.00	15.00	2.50	.....	.....	.....	.....						
Zirconium Oxide (Zirkite)		72.00	20.00	3.00					.....	.....	.....	.....	Foote Mineral Co., Philadelphia	1921
		Sodium Silicate Na_2SiO_3	Silica SiO_2	Ferrous Oxide Fe O	Ferric Oxide Fe_2O_3	Alumina Al_2O_3	Calcium Oxide Ca O	Magnesium Oxide Mg O		Water H_2O	Alkali	Volatile Matter		
Clay Birch and Other Binders														**Clay Birch and Other Binders**
Clay—Fire		.....	58.05	1.64	.....	28.30	.....	0.86	.....	7.58	2.50	.....	Miller & Coulson, Pittsburgh	1920
Clay—Fire		.....	73.80	.....	3.68	12.75	1.10	1.05	.....	.....	1.75	5.90	Garden City Sand Co. Product, Illinois Steel Co., Chicago	1909
Clay—Fire		.....	54.14	.....	5.02	27.40	0.66	0.46	.....	3.10	0.69	7.80	Clyde Iron Wks., Scotland	1915
Clay—Plastic		.....	72.80	.....	1.95	17.65	0.40	0.30	.....	.....	0.40	5.45	Peter Duncan Co. Product, Illinois Steel Co., Chicago	1909
Clay—Silica		.....	90.00	.....	0.70	5.00	1.50	0.10	2.00	.....	0.70	.....	Harbinson & Walker Refs. Co., Pittsburgh	1921
Loam		.....	73.10	.....	4.30	11.15	1.40	0.80	.....	.....	2.85	.....	Geo. Castle Co. Product, Illinois Steel Co., Chicago	1909
Kaolin, Washed North Carolina		.....	45.78	1.08	0.28	36.46	0.50	0.04	.....	15.45	0.25	.....	Bureau of Mines, Columbus, O.	1922
Hytempite Cement		3.71	64.80	.....	.....	10.51	.....	Trace	.....	.....	.....	.....	Quigley Fce. Specialties Co., New York	1922
Obtenit Fire Cement		.....	86.00	.....	Trace	8.00	.....	.....	4.00	.....	Trace	.....	Pearson Peppard & Co., New York	1922
		Sodium Oxide Na_2O	SiO_2											
Sodium Silicate (Water Glass)		6.40	24.70	.....	.....	.....	.....	.....	.....	Balance Water	.....	.....	Philadelphia Quartz Co., Philadelphia	1921
Sodium Silicate (Water Glass)		8.90	29.00	.....	.....	.....	.....	.....	.....		.....	.....	Philadelphia Quartz Co., Philadelphia	1921
Sodium Silicate (Water Glass)		13.70	32.90						.....		.....	.....	Philadelphia Quartz Co., Philadelphia	1921
		Carbon C	Hydrogen H	Nitrogen N	Oxygen O	Sulphur S						B.T.U.		
Tar—Open Hearth		77.53	6.33	1.03	14.50	0.61	.....	.....	.....	.....	.....	12260	McLain's System, Milwaukee	1919

Be sure cut—Fold along this line for binding

Cut to this point

Note—This sheet may be cut along this line and one half folded over on the other to bind in 5 x 7 inch note book.

THE FOUNDRY DATA SHEET, OCT. 1, 1924
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

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Yours very truly,

J. S. McCORMICK CO.

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TEM:R

FIG. 2—MAIN BODY CORES WERE BUILT OF BRICKS AND LOAM AND WERE REINFORCED BY GRIDS SPACED 2 FEET APART AND ANCHORED TO UPRIGHT MEMBERS BOLTED TO THE BOTTOM PLATE

The pedestal core above the bearing was built up and handled as a unit. Grids in each division made by the ribs were bolted together and the core was lifted by three hooks. The vent was taken through an opening in the base plate. The fourth side of the mold was rammed to the top of the base flange where a parting was made and a lifting plate with grid attached was adjusted in place to handle the drawback. The remainder of this side of the mold then was rammed to the top of the upper flange where a parting was made for the cope.

The two main body cores were built up at the same time that work was progressing on the outside of the mold. A lifting plate for each half was placed in the print. The plate was provided with three lifting hooks. The core was built of bricks and loam and was reinforced by vertical bars and several grids laid horizontally. The grids were laid about 2 feet apart and were bolted to one another and to the bottom plate. A special grid attached to the upper end of the vertical bars was employed to support the core overhanging the port core. The interior of the core was filled with cinders in the usual manner.

A drawback was made above the deflector and another drawback was rammed above the box marked *A*, on Fig. 5 which projected on the diaphragm side of the mold. The box was lightened by a part of the port core. The drawback was necessary to locate the port core properly. All the drawbacks were carried on small grids.

The lightening cores for the feet were rammed around suitable grids provided with hooks by which these bodies of sand were later attached to the cope. The joint then was made at the floor level and the cope flask was adjusted in place and rammed full of sand. The cope was lifted, rolled over on the floor, finished, blacked and dried.

The drawbacks and cores were lifted out in the following order: The drawback on the base plate end, the deflector drawback, the box drawback, the main body cores, core for diaphragm seat, the pedestal core, baseplate core. After the various cores and drawbacks had been removed, the projecting part of the pattern designed to form the impression marked *B*, Fig. 5, was removed. The lower flange also was removed together with the bearing and its print. The pattern was removed in sections as the removal of the cores and drawbacks progressed and where necessary, the thickness required for the metal was struck off. The loose ribs and bosses then were drawn in after which the face of the mold was blacked and finished. The mold was covered over with sheet iron and dried with a number of coke fires.

After a careful examination had disclosed that the mold was sufficiently dried the various drawbacks and cores were replaced in the following order: The oilbox core, the bearing core, the lightening core at the back end of the

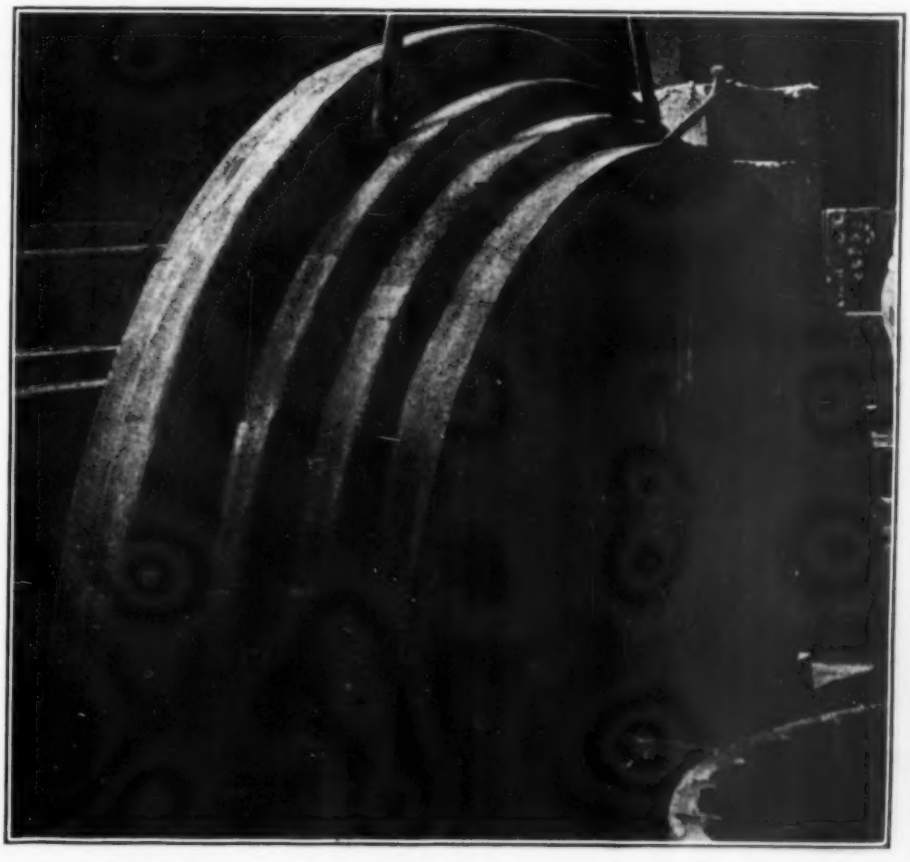


FIG. 3—CORE FOR THE DIAPHRAGM SEAT WAS BUILT OF BRICKS AND LOAM FILLED IN THE CENTER WITH CINDERS AND REINFORCED BY SUITABLE GRIDS

bearing, the pedestal core, the baseplate cores, the baseplate drawback, the diaphragm seating core, the port core, the main body cores, the deflector drawback, the deflector core, the box drawback, the thermometer box core. Extreme care was exercised in placing the various parts in their proper places to insure a uniform thickness of metal throughout the casting.

The casting was poured through two runner basins, one on each of two opposite sides. Each runner basin was connected to the bottom flange by four upright gates which distributed the iron to all parts of the mold through suitable openings in the lower flange. Additional gates at each end were plugged until the mold was partly filled. Then the plugs were removed and the added streams of iron entered the extension or feet of the casting. Two of these gates may be noted above the man's head in Fig. 5. Still another runner was cut on each side to conduct metal into the flange of the baseplate. Twelve risers were placed on the outer flange, one was placed on the thermometer box, two on the deflector and one large one on the seat for the diaphragm. The runners and risers were made up before the cope was closed down over the drag. The casting was poured from a dense close grained iron that conformed to the chemical and physical requirements demanded in the customer's specifications.

FIG. 5—VIEW OF DIAPHRAGM SIDE OF MOLD BEFORE THE VARIOUS CORES AND DRAWBACKS WERE REPLACED

Exhibit Machine Tools at London

An exhibition of machine tools and engineering materials was held at London, England, Sept. 5 to 27, by the Machine Tool Trades association. This show, which covered a wide range of machinery, was the third of its kind which has been held, the first one having taken place in 1913 and the second in 1920. The machines were practically all in operation, the greater number being used for boring, milling, shaping, planing, grinding, slotting, gear cutting and for working metals generally. A number of woodworking machines also were shown as well as others more especially adapted to foundry practice.

The Monometer Mfg. Co., Ltd., London, showed a patent die casting machine for white metal and zinc alloys which was fitted with a low pressure gas burner and automatic temperature controller. This company also exhibited both tilting and pit types melting furnaces for copper, brass, gun metal, etc., which were fired with gas, oil or coke. A gas or oil fired aluminum melting and casting plant especially designed for chill or die castings also was exhibited together with a white metal melting furnace which allows the metal to be poured directly into the bearing.

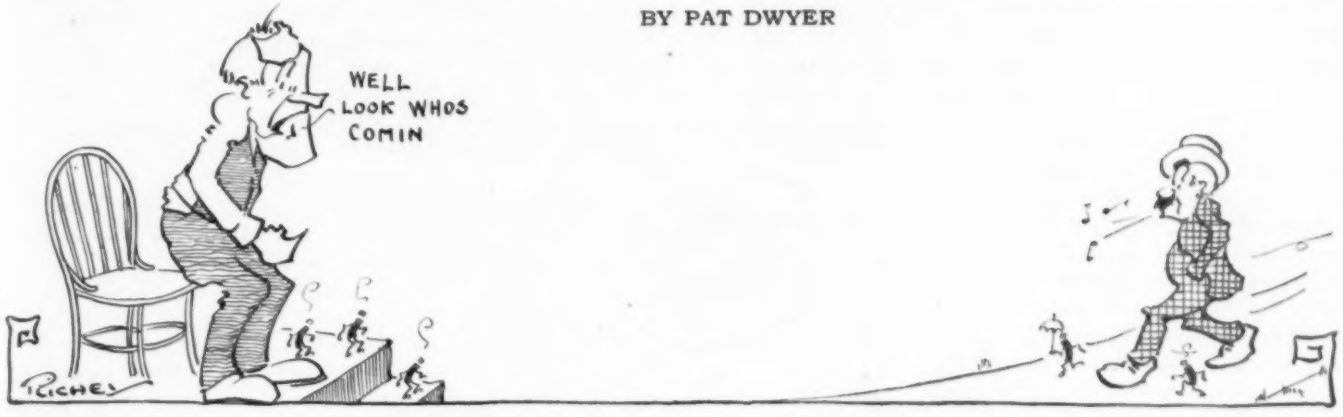
A line of pressed steel flasks, plain edge and double flanged, as well as reinforced and perforated pressed steel core plates and bottom plates were shown by A. Warden & Co., London. A machine designed for cutting off runners from large castings was exhibited by Charles Wicksteed & Co., Ltd., the machine being motor driven. A sand mixing machine was exhibited by Alfred Herbert, Ltd., Coventry. This machine has a double cage, the cages revolving in opposite directions on ball bearings. A portable electrically driven sand sifting machine was shown by John Holroyd & Co., Ltd., Rochdale. Gas fired crucible furnaces of the stationary and tilting types for aluminum, brass, etc., were exhibited by the Brayshaw Furnaces & Tools, Ltd., Manchester. This company also exhibited furnace accessories. H. E. Weatherley & Co., Ltd., London, had a display of gray iron, semisteel and steel castings, aluminum pressure die castings made from a special method.

Woodworking exhibits were shown by Wadkin & Co., Leicester, whose semi-auto universal wood miller performs numerous operations. A high speed overhead boring and recessing machine, the table of which has compound movements and may be raised or lowered, was also shown at this booth. Thomas Robinson & Son, Ltd., Rochdale, exhibited machines for pattern making, including a two-spindle saw bench for dimension sawing, a band sawing machine and a universal woodworker.

FIG. 4—DRAG PART OF THE MOLD AS IT APPEARED DURING THE PROCESS OF ASSEMBLY—SEATS FOR TWO DRAWBACKS MAY BE NOTED IN THE LOWER CENTER AND AT THE EXTREME RIGHT

Bill Investigates a Penal Institution

BY PAT DWYER



FEELING the need of a little mental and physical relaxation the other night I walked over to Bill's house. I was reasonably certain that if he once got started on any subject I need not worry about what is known as keeping up one end of the conversation. Bill likes to talk and I like to listen and as you probably have noticed at one time or another in your own experience, this is a combination that tends to promote peace and harmony among all concerned. Occasionally, if the circumstances seem to warrant the effort I may differ with him on a controversial point, but usually I am content to let him ramble along at his own gait.

He has a most disconcerting habit of deserting the main theme of an argument and wandering down some by path where I experience the greatest difficulty in following him. He has an uncanny gift which enables him to circle around on to the main path later, but by that time I don't know whether he is coming or going and as a result I don't know which side of the argument I am supposed to support. Not that it makes any material difference you know—the argument usually hinges on some inconsequential subject—but the procedure tends to confuse me and I hate to be turned inside out like an empty purse. I know purses are not so prevalent now as they were in the good old days, but you know what I mean.

On the present occasion I found him cheerfully occupying two chairs and reading a newspaper. He waved me into an adjoining chair and remarked that he was pleased to see me. The Missis had gone to see one of the numerous Sheiks of Araby at a neighboring picture joint—my word what a term!—and the children were engaged in preparing their homework. I inquired politely if he had discovered any items of interest or any item worthy of comment in the paper. I did not anticipate any extraordinary development, but one leading question is as good as another and I felt reasonably certain that he would bat out a few balls if only for practice to help maintain him in condition.

"Well," said he, "I'll tell you. Papers are not what they were. At one time a person could depend on the accuracy of nearly all the statements appearing in a paper. At election time, of course, a reader was supposed to exercise a little discretion and discount some of the statements to a considerable extent, but elections only were held at periods several years apart and the material appearing in the papers in the interim—that's a neat word, interim—was fairly accurate.

"Conditions in the newspaper business have reached such a point at present that it is not safe to believe anything that appears in the columns. I have not made any intensive study of the subject and therefore my opinion may be biased and of no particular value, but it seems to me that the readers are more to blame than the publishers for existing conditions.

"Readers demand variety, spice and large gobs of human interest in everything they read and the publishers of papers who by no means are in the business merely for their health, endeavor to give the readers what they want. There may be several other contributory causes such as careless reporting, indifferent editing and the ordinary mistakes due to the high pressure and speed with which the modern newspaper is prepared, but by and large I think my original guess is fairly close to the mark. I had a peculiar experience some time ago directly traceable to an item I read in a paper. The paragraph bore every evidence of authenticity. I believed it and as a result I landed in a penitentiary. Fortunately I entered the place voluntarily and was not invited to remain at the close of my visit.

"The item to which I refer, purported to deal with the activities of a club composed of members engaged in the sale of pig iron. Between times and when the pig iron market was soft they played golf. Many of the members developed into grand players this past year. One day I read an item to the effect that the Valley Forge chapter of the Ancient and Honorable Order of Pig Stickers intended to hold its annual golf tournament on the famous Hematite golf course. It was stated further that the president had placed an order for a gold-studded, iron, loving cup with the Bimbo Hollow-ware Co., Toroville. The cup was to be presented to the member who succeeded in going around the course in the least number of putts and shoves or the greatest number, I have forgotten which. Anyway Marquis of Queensbury rules were to govern the contest and any person violating the 18th amendment to the constitution was to be severely penalized at the 19th hole and have his license canceled. The paragraph closed with a list of the officers of the association. I was not particularly interested in any of the items set forth, but the reference to the gold studded loving cup attracted my professional attention and I decided to pay

A LITTLE MORNING TARGET PRACTICE

a visit to the Bimbo establishment at the first favorable opportunity and find out further particulars.

"I have seen silver loving cups, gold loving cups, also loving cups which I have reason to suspect contained precious little of either metal, but I never have seen one made of iron, particularly one ornamented with gold studding. I am free to confess my curiosity was aroused. This instance seems to illustrate the power of the press. It also seems to illustrate the child-like credulity of the many readers. You might say I should have displayed a little ordinary common sense. The description, palpably on the face was a hoax, an example of typical American humor. Maybe so. Maybe so. However, if you kindly will consider several factors, I think you will have to admit I was justified in my belief to a certain extent. As a matter of general knowledge I was aware of the existence of this famous pig iron club. The names of many of the officers were familiar and although I never up to that time had been in Toroville I had heard of the Bimbo Co., as manufacturers of hollow-ware. All the details were accurate, therefore why should I doubt the accuracy of the gold studded iron loving cup?

"The fact that I never had seen a cup for that character constituted no argument. I have seen many queer things in the foundry, things that I should not have believed possible unless I actually had seen them with my own two little eyes. I learned long ago that—to paraphrase one of the late Mr. Shakespeare's famous statements—There are stranger things in the foundry than ever were dreamed of in your philosophy Horatio! I may lend a somewhat skeptical ear to some of the statements I hear when a few choice spirits foregather for an evening, but I am willing to be shown. The lad from Missouri absolutely has nothing on me.

"A month or so after I had read the story I had occasion to visit the thriving metropolis of Toroville. You won't find the name on the map. For that matter the other names I have given, the association of pig iron men and the name of the club grounds also are fictitious, but if I furnished the real names, you would be no wiser. The facts are strictly accurate and that is all that really is of any importance.

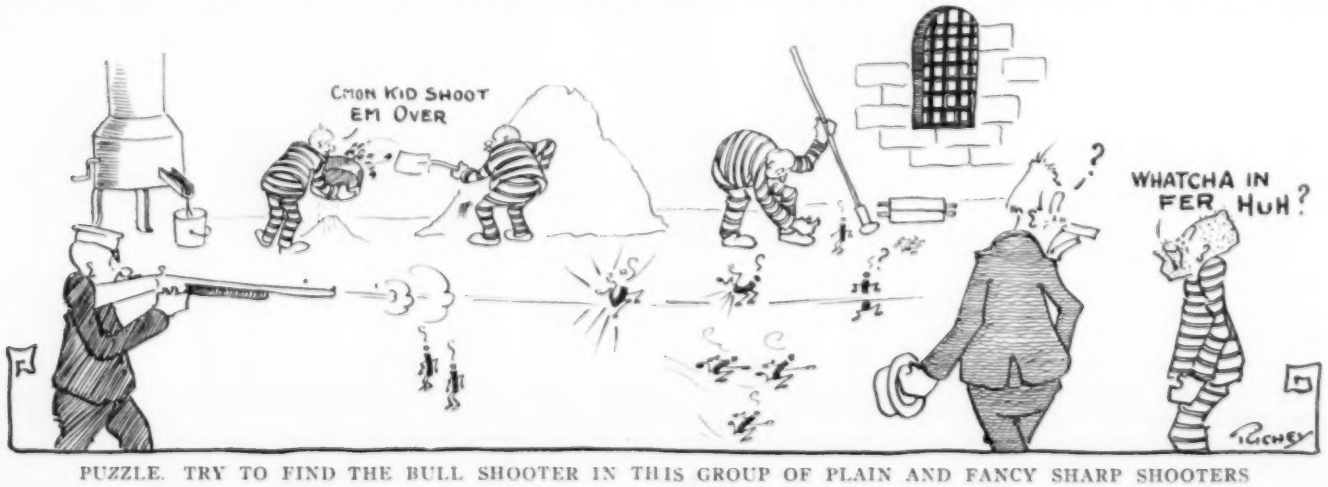
PARTY OF THE SECOND PART IS DEEPLY INTERESTED

"In this connection it is interesting to note an illuminating side light on the manner in which news finds its way into the papers. After I had investigated the story and discovered that the gold studded cup was a myth, I pursued my investigation still further and discovered the identity of the correspondent who had written the story. I wrote to him and asked him what he meant by gyping the great reading public including your innocent and trusting humble servant, in such a barbarous and perfectly heartless manner. To my surprise he replied that he had received the information in a confidential interview with the president of the club and naturally had accepted it at its face value. It is not to reason why, in cases of this kind apparently, it is but to do and die and all that bally kind of thing. My word! What!

"I always had been suspicious on general principles of these pig iron lads, but in future I intend to absolutely discredit by approximately 94 per cent everything they tell me. The next lad who comes quoting analyses to me I shall cheerfully consign to a place where I have been given to understand the phosphorus and sulphur are appreciated at their true value. A place where there are no rebates or cancellations of contracts and where continuous pouring never is held up on account of cold metal. I intend to treat 'em rough. See what I mean?"

"For the love of Michael Angelo," I said, "and all the other patrons of the art of founding in metals, give the pig iron people a rest and go ahead into the penitentiary. Sometimes I almost wish you had stayed there. You get me all set to listen to gruesome details of solitary cells, armed guards, cat 'o nine tails and slum-gullion and then you branch off into a tirade touching on the habits, despicable and otherwise of pig iron salesmen. They have their own troubles the same as men engaged in legitimate business. 'Tis true that at times they may differ from Jesse James in the single detail that they do not collect their toll on horseback, but that is all beside the point at issue. I don't want to hear any more about them or their habits and customs. Tell me of this quest of yours for the gold studded loving cup. How did you get into the penitentiary and, what I consider of still greater importance, tell me how you escaped. So far as I have been able to gather in my somewhat limited experience the law provides every facility for getting a person into one of these places, but seems singularly reluctant in providing any facilities in getting him out."

"As you were!" said Bill. "One thing at a time m'lad, one thing at a time. In other words don't rush the hearse. Kindly remember this is not an automobile parade. The mourners mostly are on foot. However, if it will keep you from boiling over—a trait that is dan-



PUZZLE. TRY TO FIND THE BULL SHOOTER IN THIS GROUP OF PLAIN AND FANCY SHARP SHOOTERS

gerous to a man at your age and in your condition—I may say that there was no loving cup. Never was, never had been and probably never will be. For your further peace of mind, I might say that I walked into the place peaceably and just naturally walked out again in the same manner after I had seen all I wanted to see.

"I noticed that the guards eyed me suspiciously as I went in and they also threw covetous glances at me as I walked out. They probably felt cheated at seeing a perfectly good specimen, as you might say, slipping through their fingers. Their business is to catch and hold everything that comes their way and they naturally resented the dip in their efficiency curve which my escape entailed. I did not indulge in any idle conversation with these gentlemen, but I imagine they take a certain amount of professional pride in their occupation.

"I don't mind admitting that I breathed a sigh of relief—maybe two or three sighs when I found myself intact and outside the gates. The place is nice and clean and the workmen are reasonably sure of steady employment for at least a period of years, but as a permanent or semi-permanent residence it did not appeal to me. I may be overly fastidious, but the living quarters appeared to be cramped and I am afraid the limited view through the bars of each tenant's front door in time begins to pall and prove extremely monotonous.

"Looking back over my experience I can remember many little incidents which should have indicated that there was something decidedly fishy about the gold loving cup story. For example when I landed at the railroad station I inquired of the lady in charge of the traveler's aid desk if she could direct me to the corner of Wood and Earnest streets. I had secured the address of the Bimbo Co., from a foundry directory before leaving home and I reasoned that the lady probably would be more familiar with the streets than she would be with the names and addresses of manufacturing establishments. She threw me rather a peculiar look I recalled afterward, but of course at the time I attached no particular significance to it. She was quite friendly, though, another feature I recalled afterward, and asked me no idle questions. She instructed me to take a certain car, transfer to a second car at a given point and told me that the second car passed the corner I had indicated. I followed instructions and arrived at the corner of Wood and Earnest streets. I felt reasonably certain that if there was a foundry in the vicinity I could trust my eyes—and nose—to find it without any further questions. I was mistaken. I neither saw nor smelled any evidence of a foundry at any of the four corners. Finally I inquired of a good natured druggist who told me it was located in a huge gray stone building on the opposite corner. He also told me the place usually was known as the state penitentiary.

"My curiosity just about flickered out at the announcement, but after a little reflection I decided that since I had followed the clue so far I might as well follow it a little farther. I walked up the steps to the main entrance. To the attendant who peered at me through the bars of the front door I said I wanted to see the manager of the foundry. He asked me several pointed questions and then, apparently satisfied, unlocked the door and admitted me to a large reception chamber where I had my first glimpse of the inside of a penal institution from the wrong side of a locked door. I intimated to the guard that such an ostentaticus display of huge locks and bundles of keys exerted a depressing influence on my mind. He laughed and assured me he would let me out again—maybe. He introduced me to a telephone where I got in communication with the foundry manager and told him at considerable length who and what I was and what I wanted. At first his voice carried an extremely suspicious note, but he finally accepted my statement and in a few minutes appeared in the reception hall from which he conducted me into the foundry. We passed through half a dozen gates which were unlocked at our approach and which to my increasing apprehension, were locked carefully after we passed through.

"The manager was extremely kind and courteous, traits which I have noted almost invariably characterize men whose foundries I have visited from time to time in various parts of the country. He was highly amused at my story of the gold studded loving cup and assured me his company never had been favored with an order to supply any casting of that character.

"I found a well organized plant in which an immense quantity of hollowware castings were turned out in the orthodox manner practiced in all foundries where these castings are made. In fact I learned that practically the only feature in which this shop differed from those on the outside was that in this establishment the labor turnover was nil. The daily attendance was 100 per cent perfect. The loyalty of the workmen was wonderful. They never laid off or quit their jobs to go elsewhere. The majority of the men had been in the employment of this company for many years and a considerable number had signified their intention of remaining for the remainder of their lives."

"Since conditions appeared so alluring," I said, "it is a wonder you did not apply for a job."

"Well," said Bill, "I'll tell you. I like a steady job, but I am not a hog. There is such a thing as a job that is too steady."

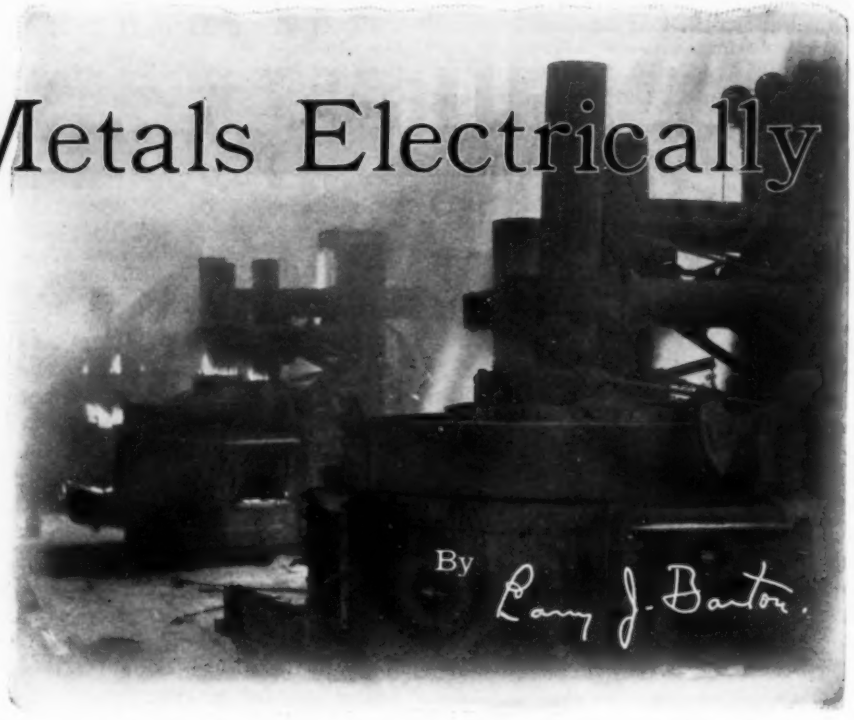
Foundry Costs Discussed

An adequate cost accounting system frequently marks the difference between success and failure for the jobbing foundry, according to M. J. House of the M. J. House Associates, New York, who spoke at the first fall meeting of the New England Foundrymen's association at Boston, Sept. 10. Mr. House's subject was "Co-operative and Uniform Cost Accounting in Foundries." He said that a cost accounting system had five principal objectives, namely, to provide a dependable basis for establishing selling prices; to give the management prompt data to use in the control of all operations; to furnish material for making estimates on new work; to uncover points of inefficiency in the operating sequence; to furnish a monthly profit and loss statement without the necessity of an inventory and with various checks to prove the whole bookkeeping procedure. The underlying principle of a modern cost accounting system should be promptness, for stale data often is of doubtful value. To secure promptness and simplicity, methods as well as individual costs should be standardized.

According to the speaker the system of cost accounting should be departmentalized even where the foundry is small. This serves as a quicker means of locating trouble and also helps in estimating. One of the chief difficulties encountered by the foundryman in determining definite costs of individual jobs is in the handling of the overhead charges. By standardizing operations and determining the overhead charge in each case the varying overhead due to changing plant conditions may be distributed properly at any time.

The department of commerce, announces that according to reports for the biennial census of manufacturers, 1923, the establishments engaged primarily in the manufacture of gas and oil stoves and appliances in that year reported such products valued at $104,174,850, together with other classes of products valued at $8,114,947 making a total of $112,289,797. Because of changes in the classification of this industry, the figures for 1923 are not comparable with those reported for 1921, but the rate of increase during the 2-year period my be roughly estimated at 120 per cent.

Refining Metals Electrically



Chapter III (Continued)

How Slag Control Affects Dephosphorizing of Basic Steel

IN MAKING basic steel several different methods are pursued, the choice depending upon the quality of the product desired, the choice of scrap, etc. The degree of both dephosphorizing and desulphurizing will tend to determine the choice of method to pursue. In basic operation the two main differences are the two-slag and the one-slag processes, which with many modifications for each give a large number of details to handle. Many melters tend to change the method of operation without considering important advantages to accrue therefrom. It is strongly advised to consider carefully any change in the procedure of melting or refining. If the present method of operation is satisfactory it is wise to continue in the same manner until it can be shown where it can be improved. If trouble is encountered ask for advice from some other man who has probably encountered the same difficulty and knows the proper move to checkmate your problem.

The two-slag method of manufacture probably is used more than any other basic practice. Two slags are used, the first being made under heavy oxidizing conditions and removed to eliminate some of the phosphorus. The second is made in a similar manner, but under a heavy reducing atmosphere, in which condition it has the ability to lower the sulphur content of the metal to a marked degree.

By far the best method to pursue in explaining the practice to follow will be to carry a heat through from beginning to end. Assume that a heat of steel is intended for a miscellaneous lot of castings, the intended analysis to be approximately as follows: Carbon, 0.22 to 0.28 per cent; manganese, 0.60 to 0.70 per cent; silicon, 0.25 to 0.30 per cent; and phosphorus and sulphur below 0.05 per cent. This is the standard specification used to make steel for the *soft* American Society for Testing Materials classification and is the analysis generally used for all types of miscellaneous work.

The furnace is charged with a general assortment of low carbon scrap, the electrodes are lowered and the arc struck. The exact procedure to follow will depend upon what type of automatic regulator is in use. If a General Electric, the main switch is thrown in on high voltage and the electrodes are lowered with the push buttons until the arc is struck, when the furnace may be thrown from hand control to automatic. If a new type of Westinghouse regulator is used, an iron or steel bar is thrust in the furnace to make contact between the charge and the furnace shell. The switch is thrown on the high side and the regulator immediately thrown on automatic. The electrodes will lower themselves until contact is made, when movement ceases until the arc is broken.

At the start of a heat some melters prefer to operate the furnace on hand control for a few minutes until a steady arc is formed, when the automatic is placed in commission. This is an aid in avoiding electrode breakage as there is small likelihood of an electrode hitting hard against the charge. With the Westinghouse regulator, there is no danger of this for the wiring is so arranged that when the electrode touches the scrap, the electrode automatically ceases moving. Consequently, the furnace may be started directly on automatic. After about 5 minutes, when a slight pool has formed, the iron bar may be taken out of the door, as contact will be assured from this time.

The current is allowed to stay on until the charge has melted down. However, certain occurrences may cause a shutdown during melting.

Often the electrodes dig so low in the furnace that the holder rests against the roof gland. When this occurs, the electrodes must be loosened in the holder and the holder raised until there is sufficient length to allow running the remainder of the heat with no further delay from this trouble. This operation generally occurs about 20 or 30 minutes after the current is turned on and requires approximately 5 minutes for the total operation. If this is done before the heat is started, there is an unusual length of electrode from the holder to the end. If the electrode tends to slide sideways on an angular piece of scrap, there is a great chance of this long electrode breaking, so that it is better to have the short 5-minute delay than a much longer one caused by breakage.

Electrode breakage is one of the worst conditions the melter has to meet in melting of a heat and although of rare occurrence, may often be of serious nature and cause considerable delay. If

Step by Step

THE two slag and one slag methods of making basic plain carbon steel are outlined in detail in the accompanying article. It is pointed out how slippage of electrodes, breakage, bridging of the charge and other contingencies may be met and suggestions are offered for avoiding them. In melting down and later refining different voltages are prefered by various melters The author gives his own preferences and the reasons for their choice. Lime, which is used as a dephosphorizing agent is added in different ways and its effectiveness may be increased by using it properly. In the forthcoming installment of this series, the chemical reactions will be followed in detail and explained in an elementary manner.

the stub breaks off for a few inches, it may be burned out safely with no difficulty. If a stub over 1-foot long breaks off, it should be removed if possible. However, this stub often is down in a hole surrounded by an impregnable wall of scrap, in which position it is impossible to remove it. The only recourse is to lower the electrodes and allow the arc to break to this stub. Soon a pool of metal will be formed and it will then be possible to hook out the stub.

The worst condition of breakage is where a full length of electrode is dropped in the furnace, due to the joint giving way. Often this electrode breaks off in such a position that its top is even with the top of the roof. The only way this can be removed is to loop a small chain around it and pull out with the crane. A small chain always should be kept among the furnace tools for just such an emergency. If a long length of electrode falls crosswise in the furnace and cannot be pulled out, it must be broken up with heavy bars and sledges and removed in pieces.

Under any condition of electrode breakage, the main trouble to guard against other than delays, is the serious pickup of carbon in the metal. When the electrode stub is removed, a quick calculation will show the approximate amount of carbon dissolved and sufficient ore may be added to counteract this enrichment.

It always is good practice to have an entire length of electrode, consisting of two full lengths, set up in the vicinity of the furnace. In cases where it would become necessary to add a new electrode, a great saving in time is made by placing this substitute electrode in commission. It must be remembered that a shutdown of any length during melting not only is harmful from time wasted, but allows a needless amount of oxide to contaminate the bath, cold air rapidly combining with the heated metal.

Bridging of Scrap

Without a doubt, scrap bridging is one of the most dangerous troubles encountered in electric furnace work, and it is the one direct cause of a majority of hearth difficulties in electric steelmaking. After the electrodes have formed a small pool in the bottom, the arc is thrown in all directions, but the greater portion of its force is downward to the point of best conductivity. During melting down, when the electrodes have been digging themselves a hole, the arc has flared and tended to partly melt the scrap in the vicinity of these paths. This tends to weld the upper layers of the charge together, especially if of such a character as will tend to bind naturally, such as long mixed bar iron.

The rising temperature of the pool, naturally aids in fusing the surrounding metal, and soon a regular roof of tightly fused scrap is formed in the furnace, just high enough from the arc so that the radiated heat is insufficient to melt it down. The result is that the metal in the bottom becomes greatly superheated, causing the hearth to fuse and holes to start. As this refractory digs out, the hot steel is lowered, and the greater volume of slag formed helps further in keeping the heat from melting out this steel bridge. Continuation of this will result either in losing a hearth completely or in such a bad hole that it may be necessary to stop and burn in a patch.

There is no reason for ever allowing this to happen, as the furnace will give adequate warning. During the general melting down, the flame issuing from around the electrodes will be strongly oxidizing, and will be sharp and pointed, often bluish in color. However, as soon as bridging starts to any dangerous degree, this flame will quickly change to a soft, luminous, yellow color, accompanied by heavy white or black smoke showing that reduction is starting. As there can be no reduction in the presence of the iron oxide on the scrap unless trouble is ensuing one may tell quickly what is wrong.

There is only one antidote for such an occurrance, that is to break down the bridge, and often this is much easier said than done. However, it must be done, so the only way to go about it is to get hooks and bars, and start breaking down a little at a time. Often it may be broken in a few minutes, but there are times when it will take 15 or 20 minutes of the hardest work to accomplish that end. After being broken down, it is generally best to add several shovels of ore, to thin the slag, and to create sufficient boil quickly to throw any still adhering scrap into the bath.

Current may be interrupted by a shut down of the main source of supply, or may be the result of trouble in the electrical end of the furnace. If the shut down is of any appreciable duration, all doors and cracks should be sealed with a heavy mud to assist in holding as much heat as possible, and to keep out cold air with its attendant oxygen.

The free melting of the charge on a 3-phase, arc-type furnace presupposes perfect contact throughout all portions of the metallic charge, if it is to act as a satisfactory neutral connection. Often due to dirty or heavily rusted scrap, poor contact is made throughout a portion of the charge, causing one of the electrodes to become isolated and lose its current connection. If allowed to proceed, the regulator will force the electrode downward and break it, or the cable on the electrode motor will unwind and often cause a snarl. Poor contact is seen when one of the electrodes refuses to arc, and the ammeter drops to zero.

Bars should be inserted in the furnace and the scrap under this electrode disarranged so that fresh surfaces may be exposed and contact picked up. If this will not work, several large size pieces of coke thrown directly under the electrode generally will carry the current long enough for contact to form underneath, the heat, fusing the pieces together. However at times, all such treatments will fail, and the only remedy then is to raise the electrode and throw several hundred pounds of some good, clean scrap underneath. Charges containing a large amount of dirty borings or turnings, and those with sand covered ladle sculls, spill, etc., are likely to give poor contact, and this metal should be so charged that this danger is minimized.

Table XXIV

How Slag Eliminates Phosphorus

No additions of ore or scale, other than on the scrap in the form of rust; no boiling, and slagging off as soon as the heat was sufficiently melted.

Pounds Lime	Per cent Phos. in slag	Per cent removed from steel
540	1.03	0.032
530	1.30	0.050
570	1.31	0.064
540	0.95	0.081
550	0.85	0.089
420	0.59	0.065
560	0.72	0.050

Avoid Power Surges

During melting down, power surges should be avoided as they tend greatly to disturb the electrical system, and place undue strain on the regulator units. Surging usually is caused by a bad boil, an exposed patch of clear metal, or by scrap falling against the electrodes.

A boil may be stopped quickly by tossing a few chunks of cold metal in on the spot, the chilling effect quickly

calming down the metal. A normal boil should approach more of a heavy bubbling aspect than a series of violent churnings. Clear metal easily is overcome by the addition of a small amount of lime to form a slag.

As the bath is approaching a well melted condition, the main body of the scrap is undermined by molten metal. Often this suddenly slips, and a dead short is made with all three electrodes. This sudden strain, unless relieved, is likely to cause serious trouble with the electrical equipment. Of course, limit switches are provided such that any overload throws off the current, but there are times when something goes wrong with this equipment, and the main brunt of the strain is thrown upon the transformer. Constant repetition of this gradually will wear down the electrical equipment until a failure occurs, with its long and costly delay.

The remedy for this is to raise the electrodes as soon as the scrap approaches the falling condition, and poke it into the bath with bars. The walls may be well cleaned of metal and the current again turned on. It is much better to waste several minutes poking it than to allow the scrap to fall with the chance of breaking an electrode or ruining a transformer.

Overload Heats

Often heavy, overloaded heats are placed on the furnace such as requiring a 3-ton furnace to pour 6 tons of metal. In many such instances it is impossible fully to charge the heat on one operation, and further scrap must be added after melting down. In such an instance, this practice is all right because it is a necessity, but under any other circumstance this addition of cold scrap to a melted bath should be rigorously avoided.

In the first place it constitutes a heavy chilling effect, often a heavy scull being formed on the bottom, and around the walls, requiring an unusual amount of energy to melt it free. Again, the addition of oxide to a melted metal does not improve quality, the metal in this pasty state being in exactly the right condition to dissolve a part of this unwanted element. It has been found in most instances that the time lost, and added power necessary, overbalance any gain from the larger sized heat, although there are melters who strongly advocate such practice.

Another point of controversy is the proper voltage with which to melt the charge, and whether two or more voltages are superior to one. To show to what extent this difference of opinion goes an examination of a few of the different furnaces on the market denotes the wide difference. For example, the Heroult furnace is installed with two different alternative arrangements; one having a single voltage of from 160 to 110, the other having a melting down voltage of approximately 130, with the transformer so arranged that various selections may be made for the refining voltage. In one particular shop the transformer was so arranged that there were six possible combinations ranging from 60 to 130 volts.

This is standard on the majority of present furnaces. A new innovation was brought forward by the Pittsburgh Electric Furnace Corp., Pittsburgh. Appreciating the value of speed in the steel-making activities of a foundry, this company gains a point by using relatively high voltages, differing greatly from the present standard practice. The transformer is connected so that a voltage of approximately 180 is used for melting down, with a voltage of about 100 for finishing and refining. The natural result of this long arc is a much faster melting operation with its attendant economy.

On basic operation there is ground against the long arc is the fact that it is conducive to the fixation of nitrogen, which dissolving in the steel is the cause of every trouble from a plain gas bubble to a faint *ghost line*. The writer in operating this furnace on both basic and acid hearths has followed carefully the quality of the steel, and has found it to be the equal of quality of that made in other types of furnace.

On basic operation there is ground for the argument against such a long arc, as it tends to perform its melting so quickly that the action of the slag has not sufficient time to function thoroughly. On basic operation a melting down voltage of from 120 to 130 volts is recommended, with a refining voltage of from 90 to 100. On acid operations a melting down voltage of from 160 to 180 is right, with a refining figure of from 100 to 110 volts.

Melting Down the Heat

Assuming that none of the above troubles are encountered, the heat is allowed to melt down to the point where the scrap is beginning to undermine, when the current is shut off, the electrodes raised, and as much of the scrap poked in as possible. Often this is unnecessary, the scrap gently sliding into the pool as the bottom portions gradually are melted away. From this point on, the heat will require certain working to bring the first slag into a satisfactory condition. This first or dephosphorizing slag is composed of lime alone and may be added to the furnace in several different ways.

The lime may be charged directly on the hearth before the furnace is charged with scrap. While this practice is widely followed, it is not to be recommended as its use in this manner tends to build up the hearth. As the bottom of a basic furnace always tends to rise with the best of practice, requiring constant attention to cut back to shape, this is only causing extra trouble for the furnace crew resulting in an increase in lost time and giving trouble with the slags during this period.

The lime may be mixed with the scrap during charging or placed about the center of the charge, between the layers of metal. The objection to this arises from the fact that lime is a poor conductor of electricity when cold and when placed in this manner might be so arranged that different parts of the charge would become insulated from the remainder, causing difficulty in making contact.

Lime Under Electrodes

A third method is to add the lime under the electrodes as soon as the first pool of metal forms. Often this is performed by raising the electrodes when they have dug a deep hole, adding the lime and filling up these cavities with fresh scrap.

Extensive experiments have been conducted on this point by the writer and more uniform results were obtained by the latter practice than by any other. This is the hottest point in the furnace and it is easy to strike an arc in the presence of these hot gases regardless of whether lime is present or not. Furthermore, this is the point where the greatest amount of physical action is had, due to the churning of the metal by the force of the arc. Consequently, this lime is mixed rapidly to form a slag and always being exposed to any oxide as the scrap melts, tends to pick up the oxide before it has any tendency to dissolve in the metal.

How much lime is needed for this slag? Assuming that the amount of phosphorus to be eliminated is about 0.03 to 0.04 per cent, it will be necessary to add sufficient lime adequately to carry this amount. In addition to the amount of lime necessary to carry off the phosphorus, sufficient must be present to form a slag with the silicon, the manganese and any foreign matter in the charge, besides having enough to form a blanket for the metal. As all the heat necessary to melt and hold liquid, this slag is wasted as far as its effect on the kilowatt hour per ton of metal value is concerned, the minimum amount which will adequately satisfy all of the above points must be used.

Experience has taught that an amount of lime equal to from 2 to 4 per cent of the weight of charge is suffi-

(*Concluded on Page* 788)

Ohio Founders Get Together

Varied and Interesting Features in Program Presented for Consideration of Members of Foundry Association Assembled From All Parts of the State of Ohio

SEVERAL phases of the many sided problem involved in the operation of the foundry were presented before 200 members of the Ohio State Foundrymen's association at its fourth annual convention held at the Cleveland hotel, Cleveland, Sept. 18 and 19. The addresses ranged in scope from local issues touching on the duty and neglect of duty on the part of a congressman to a presentation of views upon the European situation with relation to its probable effect on the American foundry industry and from a discussion on how to improve the morale of the working force to an eminently practical presentation of how a cost system functions and the manner in which it should be applied to meet local and individual conditions.

Judge William Huggins, former judge of the Kansas industrial court and now connected with the League for Industrial Rights, New York made a strong plea for the establishment of more harmonious relations between employer and employe. While fully conceding the constitutional right of both employers and employes to organize, he strongly deprecated the strong arm and bludgeon method too frequently employed in securing concessions, one from the other. A bargain ceases to be a bargain when it is consummated under duress, the judge said. Practically every factor connected with industrial operation has been changed during the past 100 years and it is idle to pretend that present century conditions can be solved by past century methods.

Dr. H. Myers, Dayton Malleable Iron Co., Dayton, O., speaking on the theme that the forces which create an organization cannot be bought but must be developed, claimed that the health of the workman is a most important asset and still it is an asset that in the majority of cases receives scant consideration. Mental trouble according to the doctor affect a man's efficiency and his calue as an employe, fully as much as sickness of the body or lost time due to accidents. As a remedy for one he proposes the establishment of a dispensary in every plant together with the full or part time services of a physician. To relieve the second condition he advocated a loan department, through which workmen may receive financial assistance at critical periods.

He stressed the importance of the foreman as a point of contact between the men and the management and advocated the establishment of foremen training classes in which foremen may be taught in detail the policies and views of the company to maintain the proper and accurate attitude in dealing with the men. He outlined a program for the monthly meetings including discussions on waste, production, better product, sales problems, personnel, supervision, loans, etc.

Various cost methods—correct and incorrect were described by E. T. Runge, F. T. Runge Cost Co., Cleveland. He used a series of blackboards with examples already worked out to illustrate the points in his address. The speaker described the fundamental principles on which cost accounting is based and stated that there is no such thing as a ready made system that may be applied to any plant. Any system installed in a plant, inevitably will have to be modified and adapted to meet operating conditions. The changes are incorporated after the system has been in use for a few months and after the foundrymen has had an opportunity to test its value and practicality. The discussion which followed the presentation would seem to indicate that the subject of costs easily leads all others in importance.

Feasibility of endowing a chair in foundry engineering in the various universities was considered by C. C. Smith, Toledo Steel Casting Co., Toledo, O., in an address dealing principally with the place of the local organization as a unit of a national organization of the same character. While admitting the acknowledged trend of the foundry industry toward simplification of process and more extended adoption of mechanical equipment, still, Mr. Smith claimed a need always will exist for competent superintendents and other executives and their chance of receiving adequate training in the shop itself is becoming less and less each day.

At the banquet on Thursday evening H. Cole Estep, recently returned from England where he has served for five years as European manager of the Penton Publishing Co., Cleveland, summarized impressions touching on the metal industry gained abroad. He stated that the sentiment in Great Britain, France, Belgium and Holland is most distinctly against the Dawes plan. The sentiment is dictated partly by economic reasons. To raise funds Germany must export and sell goods and thus come into intimate and ruinous contact with the trade of the other nations cited. Business still is in a delicate and precarious condition. In the second part of his address Mr. Estep touched briefly on the principal points of an address that was to have been delivered by A. O. Backert, president and general manager of the Penton Publishing Co. and which Mr. Backert unavoidably was prevented from delivering in person. He stressed the point that the gray-iron casting industry has not kept pace with the development of the malleable iron and steel casting branches and questioned whether this condition was not due to a lack of progressive spirit on the part of gray-iron foundrymen. He cited the research work of the American Malleable Castings association and work of a similar character carried on by the Steel Founders Research Group, and urged broadening the field of service for gray-iron products.

S. F. Fannon, Sherman Service Inc., delivered an address on the *75-cent dollar in industry.*

That simplified practice is a profit making policy was the contention of R. M. Hudson, chief of the division of simplified practice, United States de-

Officers of Ohio State Foundrymen, 1925

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partment of commerce. Profits do not always come from volume business at good prices, he said, nor do they always come from low costs. As a rule the most successful business is that in which volume is built on quality products, dependable deliveries and fair prices, good materials, modern machinery, up to date methods and good wages. The most practical method to increase profits under present conditions is to prevent waste either of time or material.

E. S. Carman, chief engineer Osborn Manufacturing Co., Cleveland, described in considerable detail methods of reducing production costs with particular reference to molding and sand handling equipment. Instances were cited and comparisons drawn between castings that were made under haphazard conditions and those made in a plant where every mechanical appliance was provided to increase production and thereby reduce the unit cost.

On the evening of the 18th the foundrymen attended a banquet in the ball room of the Hotel Cleveland, followed by a smoker and several acts of vaudeville. The party was taken for a sight seeing tour of the city on the morning of the 19th which culminated in a tour of Nela Park where the laboratories of the General Electric Co. are located.

Molding Machine Driven Electrically

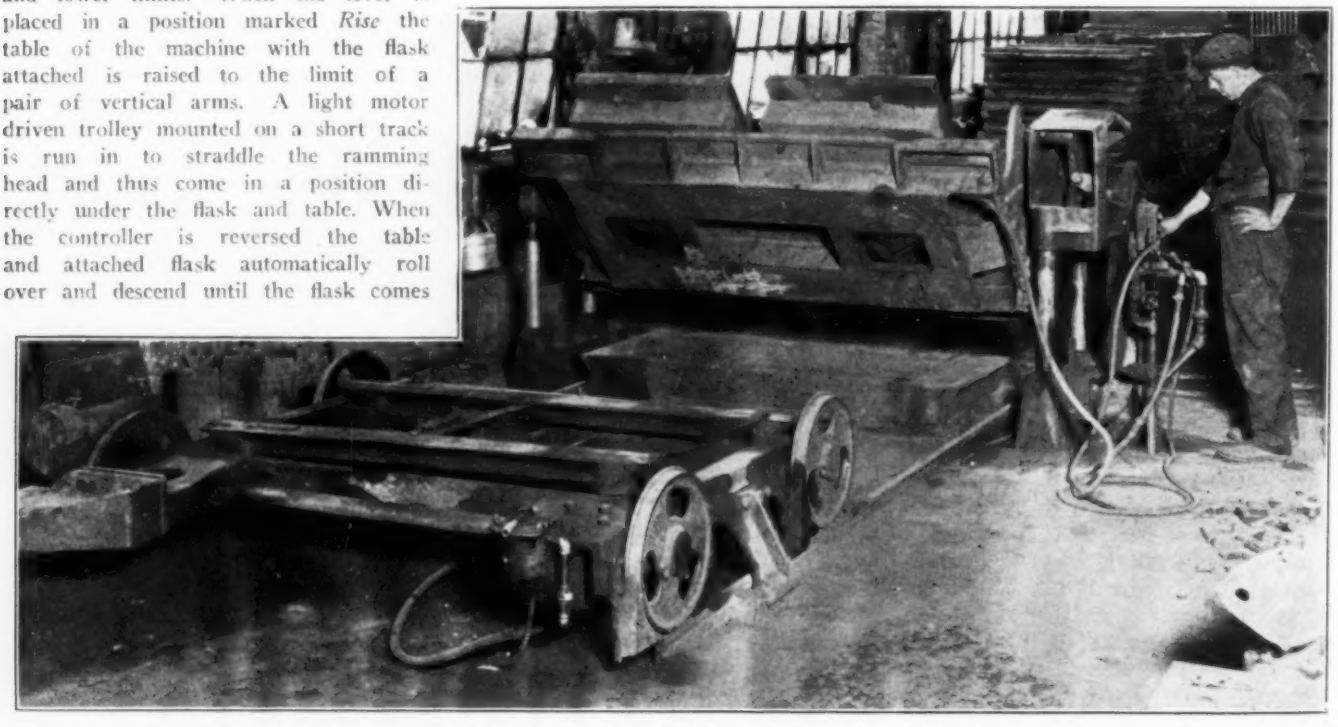
APPLICATION of electric power to every operation of a molding machine with the exception of ramming the sand, is illustrated in a type of rollover pattern draw machines made in various sizes with lifting capacities ranging from 1200 to 12,000 pounds. One of these machines fitted with a cope and a drag pattern and thus in a position to ram a complete mold at each cycle of operation is shown in the accompanying illustration. The machines are made by the Osborn Manufacturing Co., Cleveland and the electric equipment is supplied by the Westinghouse Electric & Manufacturing Co., East Pittsburgh.

Both manual and automatic controllers have been developed for use in connection with these machines. In the manual controller, six armature speed points are provided in either direction of rotation. Limit switches automatically bring the motor to rest at the upper and lower limits. When the lever is placed in a position marked *Rise* the table of the machine with the flask attached is raised to the limit of a pair of vertical arms. A light motor driven trolley mounted on a short track is run in to straddle the ramming head and thus come in a position directly under the flask and table. When the controller is reversed the table and attached flask automatically roll over and descend until the flask comes to rest on the car which is provided with two sets of leveling pins. A single lever at the side locks all the pins in position immediately after the flask comes to rest and before it is disengaged from the table.

After the clamps are removed the controller lever is placed in the *slow draw* position. It is left in this position until the table with pattern attached once more has been raised to a point where it will clear the mold. The lever then is moved forward to the *full speed* position and the table and pattern are raised to the limit of the arms referred to previously. The car with the mold is removed to a point where the mold may be removed by the crane. The lever is reversed and the pattern plate rolls over and descends until it once more rests on the ramming head of the machine. The cycle then is repeated.

The automatic magnetic controller presents the advantage of smoother and quicker operation and eliminates the hazard incident to the operation of any mechanical device in the hands of unskilled labor. Push buttons take the place of the control lever. In operation, when the first button is pushed the mold is raised, rolled over and poised until the car is run in underneath. Dynamic braking secures quick and accurate stops. The remainder of the operation is similar to that described with the single difference that the operator pushes two buttons instead of reversing a lever.

The motor is mounted on a bed plate hinged at one end and suspended by a spring at the other end. This arrangement minimizes the vibration incident to the jolting operation of the machine. The motor is direct connected through a flexible coupling to the worm shaft of the machine and is protected from any sand that may filter from above.



ELECTRIC PUSH BUTTONS ARE LOCATED AT A CONVENIENT POINT CLOSE TO THE LEVER WHICH CONTROLS THE AIR VALVE FOR JOLTING THE MOLD

How and Why in Brass Founding

By Charles Vickers

Porosity in Castings Under Steam Pressure

We are forwarding two samples of wash-out plugs marked No. 1, and No. 3, with the following analyses: No. 1—Copper, 85.93 per cent; tin, 4.51 per cent; lead, 4.30 per cent; zinc, 5.10 per cent; impurities, 0.16 per cent. No. 3—Copper, 86.04 per cent; tin, 5.33 per cent; lead, 2.87 per cent; zinc, 5.76 per cent. The specifications under which these castings are made call for the following: Copper, 84 to 86 per cent; tin, 4 to 6 per cent; lead, 4 to 6 per cent; zinc, 4 to 6 per cent. The defect in No. 1 plug you will note, is blowholes, and we want your opinion in regard to whether these are due to improper melting or improper molding. No. 3 shows fairly clean brass, but the casting is porous under high steam pressure, and we would like your opinion in regard to improving this situation.

We believe that an increase in the tin with a reduction in lead, and possibly zinc is desirable in a casting subjected to superheated locomotive boiler pressure. However, our principals are of the opinion the alloy as specified is what is wanted and it will be necessary to produce them of this composition until we are able to convince them it is incorrect.

The alloy specified is the old fashioned *ounce* metal, now known as eighty-five and three fives. It is sometimes called a steam metal but its use should be confined to low pressures. It cannot be expected to withstand superheated steam, as the best bronzes fail under such service. Ounce metal is merely a good grade of red brass, or composition. It is not a bronze, and while the latter class of alloys sometimes are used for moderate degrees of superheat they are not especially suitable for such work. Ounce metal being inferior to such an alloy as 88-10-2 for such service, should not be used under superheated locomotive boiler pressures.

The trouble with copper-tin bronzes is due to a rapid loss of strength under temperature rise. A bronze which at normal temperature has a tensile strength of 34,000 pounds per square inch, with elongation of 36 per cent, will at a temperature of 660 degrees Fahr., which is a common working temperature for superheated steam, have a strength of approximately 12,000 pounds per square inch, and the elongation of a No. 12 aluminum alloy, one per cent or a trifle more. It will be seen then that the best in copper-tin alloys is none too good, and *ounce* metal is far from the best. If a bronze has to be used an alloy of tin 9.5 per cent; zinc 2 per cent; lead 0.5 per cent and copper 88 per cent would be as good as could be expected with the ordinary brass foundry alloys. Copper-nickel-zinc-iron alloys are also used for superheated steam, but they are difficult to cast, so that all things considered an aluminum bronze containing 10 per cent aluminum, one or more per cent of iron, the balance copper has much to recommend it. As this alloy is tough and malleable at a red heat, it is successful for still plugs used by the oil refining industries. The defects of No. 1 come both from molding and from the metal. The casting looks as though it was an experiment by some amateur. It evidently was not made by a skilled brassmolder. No. 3 leaks because the metal is unsuitable. Both plugs contain considerable iron which indicates they have been made from scrap metals. The iron was determined to be present by analysis. While iron sometimes is good it has to be used with knowledge and discretion.

Formula for Cores

We desire a formula for a core mixture for use in aluminum castings that will not be hard and still can be handled; also what should be sprayed onto the core to harden the surface?

The following mixture for cores is used by several concerns: Sharp sand, 45 parts; molding sand 45 parts; powdered rosin 2 parts; flour 1 part. Spray the cores with molasses water to harden the surface bake in an oven hot enough to thoroughly melt the rosin. When cores containing rosin as a binder are heated by the molten aluminum, they become soft again and so permit the casting to shrink.

Bearing Metal Formula

We wish to make our own babbitt and want a formula for the high speed babbitt and also one for a cheap babbitt.

A high grade babbitt is what is known as *genuine* babbitt. The composition of this follows: Copper, 3 per cent; antimony, 7 per cent; tin, remainder. A good lead base bearing metal is as follows: Antimony, 15 per cent; tin, 5 per cent; lead, remainder.

Crucible Making Brings Many Difficulties

As we have difficulty in obtaining crucibles delivered regularly we desire information as to the formula from which they are made, so we can make our own, providing the process is a simple one. We also want the formula for the so-called French molding sand.

The best crucibles to use for melting brass are known as plumbago crucibles. They contain a proportion of graphite, which increases their heat conductivity and refractoriness. The manufacture of crucibles is anything but a simple matter. Not only must the best mixture of the ingredients, clay, carbon and silica, be known but the manner of mixing, ageing, drying, and burning them must be understood. Otherwise, it will be difficult to get them to last even for one heat. Clay crucibles, which are made from a mixture of carbon, such as coke dust and china or other fireclays, are not suitable for use in brass foundries as they do not last long enough to pay for the trouble of making them. Plumbago crucibles are the only melting vessels it will pay to use and as these cannot be economically made by the consumer it is necessary to purchase them from reliable makers. Most of the crucible makers are reliable, for should they be otherwise they do not last long enough to make any impression on the trade. We advise against attempts to make crucibles as they will only lead to disappointment since they are a highly specialized article to manufacture. However, when crucibles are not obtainable they can be dispensed with by using noncrucible furnaces to melt with and carrying off with ladles. A good design is a firebrick lined cylinder rotating on hollow axles attached to the center of each end, and through which the oil burner is introduced. A hole is cut in the circumference and a door fitted to put in the metal when charging and to pour it out when molten.

Such furnaces may be purchased from experienced makers and they will give results equal to crucibles after the operator has learned the best method to manage them. This is not difficult and calls merely for the exercising of common sense.

We are not aware of a formula for French sand as it is not a mixture but a natural product.

British Institute Meets In London

The autumn meeting of the British Institute of Metals was held in London on September 8, 9 and 10, Professor T. Turner of the University of Birmingham presiding. It was announced at the opening session on Tuesday, September 9, that Professor Turner had been elected president for 1925. Sir John Dewrance, chairman of Messrs. Dewrance & Co., Great Dover street, London, and Sir William Smith, London were elected vice presidents. The resignation of A. E. Seaton who has held the post of honorary treasurer for the past seven years was accepted and a vote of thanks was extended for his valuable services. The new secretary is J. H. Fry, London.

In his opening speech Professor Turner announced the recent death of Sir George Thomas Beilby, past president of the Institute.

American contribution played an interesting part in this meeting. On Monday evening, September 8, W. M. Corse, National Research council, Washington, who was appointed honorary corresponding member of the council for the United States at last year's annual meeting, gave a lecture entitled, "Recent Development in Nonferrous Metallurgy in the United States, with Special Reference to Nickel and Aluminum Bronze." The first paper on the next day "The Method for Measuring Internal Stress in Brass Tubes" was by Robert J. Anderson, Boston, and Everit G. Fahlman, Cleveland. This paper was introduced by Mr. Corse and was followed by interesting remarks by Professor Kotaro Honda of the Tohoku Imperial University, Sendai, Japan, by Dr. Rosenhain of the National Physical laboratory, and Professor Turner.

In the course of the meeting the seventh report of the corrrosion research committee was presented by Professor Bengough, Royal School of Mines, South Kensington, London, and R. May, London. In summarizing this work Dr. Bengough laid particular stress on that part of the report dealing with the corrosion and protection of condenser tubes. An interesting discussion followed in which Professor Carpenter of the Royal School of Mines London, announced that the research work covered by this committee will in the future be pursued, as far as the technical side of this subject is concerned, by the department of industrial and scientific research which is taking over the services of Professor Bengough and his co-workers. However, it was decided, that the practical side of these investigations should be carried on as in the past by the Institute of Metals.

At the end of the meeting it was announced that the next annual meeting will take place on March 11 and 12, 1925.

Examine Hardened Copper Story

Since the recent newspaper story of the wonderful discovery of the lost art of hardening copper by an automobile mechanic and the immediate sale of the *secret* for an unbelievable sum cash in hand, the bureau of standards has received numerous inquiries concerning this and similar process. From a set of samples submitted by one party, undoubtedly prompted by the newspaper story referred to a typical piece was selected for examination as an example of the line along which such inventors work.

The chemical analysis showed the following results:

	Per cent
Copper	91.
Aluminum	7
Manganese	0.26
Lead	0.10
Iron—less than	0.10

It is evident from this that the so-called *hardened copper* was merely an aluminum bronze. An alloy known for a good many years and having considerable use at present. In addition the attempt has been made to stiffen and harden the material by rolling. The result, was decidedly inferior to what would be fair commercial practice.

In general it may be said that present day metallurgists are quite familiar with the general means which may be used in hardening copper or other metals. Essentially they are chemical in nature, alloying additions or physical cold working or combinations of the two methods.

Use of Copper Grows

The Copper and Brass Research association estimates the total amount of copper used in automotive manufacturing last year as at least 170,000,000 pounds, and states in its comprehensive analysis that a consumption of 200,000,000 of this metal for 1924 is no longer impossible.

According to an announcement of the department of commerce, census reports show a considerable decrease in the activities of the establishments engaged in the manufacture of aluminum products during the year 1921 as compared with 1919. The total value of products reported for 1921 amounted to $45,822,000 and for 1919 to $75,278,000, a decrease of 39.1 per cent.

Refining Metals Electrically

(*Concluded from Page 784*)

cient to satisfy all of the foregoing points. This amount will vary, depending upon the phosphorus to be eliminated, the cleanliness of the scrap and other considerations. It does not have to be accurately weighed, but can be calculated by the scoopful and about half thrown in the holes under the electrodes as the heat melts, the remainder being added as soon as a fair-sized pool is formed. The entire amount ordinarily will be in the furnace approximately 45 minutes after the current is on, in a furnace taking about 2 hours to melt the charge. As the metal melts, all impurities and the oxidized alloys contained rise to the top and slag with this lime. This forms an excellent blanket of rather thick slag which is a decided advantage. This thick body of slag does not radiate heat well, the main body of the heat being transmitted to the steel bath below, a minimum of the arcs radiation being thrown against the roof or side walls.

Phosphorus Removed

Tests made on a 6-ton Heroult furnace, melting approximately 8 to 9 tons of a charge, largely made up of railroad wrought iron show the effect on phosphorus removal. The results of this test are shown in Table XXIV.

The amount of phosphorus eliminated may be increased by the addition of sufficient amounts of ore to keep the bath in a steady boil or in special cases more than one dephosphorizing slag can be used.

As the heat melts and this slag becomes more contaminated with oxides, its viscosity is lowered. It often becomes thin and runs like water. When this occurs more lime must be added to keep this slag in a fairly thick condition. When the bath has melted completely and is hot enough to retain its molten condition for 10 or 15 minutes, the current is shut off and slagging off begins. Flat, hoe shaped, rabble bars are used to push the slag toward the tapping door, or in certain makes of furnace, the slagging door, where it is pulled out with bars and hooks. Often the rabbles are made with a wooden edge, as these are more suitable for raking the slag and the metal does not adhere to its surface. As soon as the greater part of the slag has been removed in this manner, a further addition of lime is thrown in the furnace and the metallic bath absolutely cleaned of any remaining slag. The furnace is tilted back into normal position and is ready for finishing the heat.

Milestones in Foundry Progress

As Recorded in the October Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

MORE than 80 members of the Western Foundrymen's association and guests spent a day at the Illinois Steel Works, South Chicago, after which they returned to the Palmer house and, filled with food and gratitude, held a meeting where E. C. Potter explained the details of blast furnace operation. George M. Sargeant, was then president of the association, according to THE FOUNDRY of Oct. 10, 1894.

* * *

One of those present when called on for a speech told the yarn of the hard swearing teamster whose horse fell in the street. To the expectant crowd, the profane one announced, "I am unequal to the occasion." Remember that one? Sure, he did!

* * *

The N. M. Neal Foundry Co., Auburn, N. Y., was putting in a substantial floor of clay, rammed and rolled and covered with sand.

* * *

When you're picking up your gaggers,
From off your castings top,
If there's any of them won't come loose,
You can bet you've had a drop.

* * *

The Bass Foundry & Machine Works, Ft. Wayne, Ind. was making a large truck to be used in moving heavy castings. Four days previously had been required to move a 20-ton casting from the foundry to the machine shop.

* * *

THE FOUNDRY believes that the greatest enemy to prosperity in this country at this minute is the pessimistic, dyspeptic, bilious individual who is permitted to run at large and predict all kinds of disaster as a result of this or that political policy.

Wonder who started that. Of course, 1894 was not a Presidential year so something else must have prompted this editorial comment. Sounds fair enough today.

* * *

The old foundry at Albia, Ia., was sold to parties who turned it into a corn-cob pipe factory.

* * *

Henry Hansen had a four page article on the universal scape goat for all castings ills—the blacking. Most troubles for which poor blacking furnished the alibi, Mr. Hansen said, could be ascribed to poor use of good blacking.

* * *

No. 2 pig iron continued at $11.00 to $11.50 a ton, Pittsburgh.

Faked Foundry Facts

Whistlers

REMEMBER the exposition in St. Louis during that year? A model foundry constructed through the co-operation of manufacturers of equipment, provided with sundries by the supply producers and actually in operation in the Gulch was featured in the October, 1904 issue of THE FOUNDRY.

* * *

Wm. H. Jackson Co., New York, had just completed casting two bronze name plates for the Williamsburg bridge. These had a total length of 52 feet 7 inches, were 4 feet 3 inches wide and weighed 3 tons apiece. They were cast in three sections, and the thickness was only 3/8 inch. The metal was melted in a cupola.

* * *

The following durable jest probably caused J. Caesar to burst the buttons from toga.

An old man was noticed on the street possessed with mirth and laughter. Passing curious person inquires the reason. Old man, between guffaws says, "Ef some folks air not gettin' to be reg'lar durn fules. The idee uv hangin' up er sign tellin' peepul that 'cast iron sinks'."

* * *

A large portion of the foundry capacity of the country was idle and blast furnace tonnage was declining. Iron could be had in northern Ohio for $11.75 to $12.00 delivered at the plants.

* * *

Harry Willis has a short article on foundry practice in New Zealand.

* * *

Harrington Emerson outlined the percentage method of determining production costs.

* * *

In ye olden tymes, when knowledge was power
And chemists fought shy of the foundry;
The foundryman studied the grades and the blower,
When he felt in a bit of a quand'ry.
'Tis certain he could mix materials crude
And satisfy all—aye and sundry,
But that was before the days of drugged ore,
Or the chemist came into the foundry.

* * *

This and much more of the same demonstrated that Vinculum, which probably was not his real name, still kept his poets' license tacked on his corcroom door and his rhyming dictionary close at hand.

OCTOBER, 1914, marked the Post-Convention issue of THE FOUNDRY dedicated to the Chicago gathering of the American Foundrymen's association. R. A. Bull was president, while the vice presidents included: H. E. Field, S. R. Chadsey, H. A. Carpenter, T. W. Sheriffs, J. J. Wilson, J. P. Pero, A. T. Drysdale, A. H. Thomas, Walter Wood and B. D. Fuller. A. O. Backert was secretary-treasurer. Robert McDonald was elected president of the Associated Foundry Foremen.

* * *

On Sept. 15, 1914, 6507 castings plants were reported in the United States and Canada, from statistics compiled from *Penton's Foundry List*, giving a decrease of 31 shops when compared with the 1912 total.

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....406 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND, 2-3 Caxton House, Westminster, S.W.1
PARIS FRANCE.....23 Rue de la Bienfaisance VIIIe
Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

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What is Wrong with Gray Iron?

DURING the past 20 years, gray iron castings production has failed to keep its place in the steady advance of industrial development. A statistical study prepared for the Ohio State Foundrymen's association by A. O. Backert, president, Penton Publishing Co., and for many years editor of THE FOUNDRY, shows the alarming facts in vivid fashion.

In 1903, foundry iron production represented 25 per cent of the total of pig iron made in the United States. In 1913 foundry grades had declined to 13 per cent of the total and during the next period of ten years stood practically still, giving only 14 per cent as the ratio of foundry iron to the total pig iron production in 1923. During the first period of ten years, the country's output of iron increased 70 per cent, but that devoted to gray iron castings production only advanced 15 per cent. Twenty years ago, the annual output of pig iron was slightly more than 18,000,000 tons per year, and in 1923 it amounted to over 40,000,000 tons, giving an increase for the past two decades of 125 per cent, while foundry iron has gone ahead only 31 per cent in the same period of time.

Retaining the increase in total output of pig iron in mind, consider how malleable grades have fared. In 1920 the total malleable iron production had increased 210 per cent compared to 1903. Much of this phenomenal growth may be credited to activity of malleable foundrymen in improving their product and in widening the field of demand.

A similar descrepancy is evident in comparing foundry iron with the figures for steel castings production. In 1923, the total steel castings output is given as 430,000 tons. This was increased to 1,020,000 tons in 1913 or 140 per cent over 1903 and to 1,458,000 tons in the past year, giving a gain of 240 per cent for the 20-year period from 1903 to 1923.

Thus it will be noted that while malleable and steel castings production have gone ahead apace, the gray iron branch of the industry has lagged. This is the more apparent when it is considered that such important classifications as automotive castings have been added to the total of gray iron and the growth in demand for radiator and heater castings, pipe and sundries and all of the standard products of the gray iron shop must, at least, have grown in step with the country's normal development.

It is significant that the total number of gray iron foundries in operation in the United States registered a drop during the past two years. Statistics just compiled from the new edition of *Penton's Foundry List* show that 261 gray iron shops have passed out during that period.

These facts should be taken as guide posts pointing a trend, and in no sense as preliminary to an obituary of the gray iron castings industry. No doubt the encroachment of other castings, steel stampings and forgings, reinforced concrete and rolled shapes all have an influence. Gray-iron castings are valuable for many purposes and can be made to bear much more of a share in engineering service. They have properties which too often are discounted by manufacturers of competing commodities, and the lack of definite standards made known through usage or through advertising has served to handicap gray iron.

The field of service for the gray iron can be enlarged. Research, co-operation in improving the quality of the metal, advancement of new ideas for uses of iron castings, and education of the buying public are needed in the industry.

Trade Outlook in the Foundry Industry

CONTINUED gradual improvement is noted in general industrial lines. This is reflected in increased movement of freight, in declining unemployment figures, in the higher rate of operation of factories and in the sale of basic commodities. The National Association of Purchasing Agents, through its secretary, Mark Kuehn, Cleveland, notes that the consumption of coal for all industrial purposes registered an advance of 11 per cent in August over the total for the previous month. Further, after four months of steady decline, the production of by-product coke recovered somewhat in August. In line with other industries, foundries report slight improvement in orders and inquiry alike.

Railroads Active

The last week in August witnessed freight car loadings in excess of one million for the first time in the present year. In fact, the total of 1,020,339 cars is the largest since the week ending Nov. 10, 1923. Peak loadings of grain, coal and general commodities are expected during the last of September and October, and with the drop in surplus cars railway buying is predicted. The August orders for cars totaled 5984, the largest figure since April and considerably ahead of the July total of 886 cars. By the middle of September, orders for 21,000 cars had been placed and inquiries were in the market for about 12,000 additional. The early September orders were greater than the total placed for the first four months of last year, and indications pointed to a close approach to the high February total of 41,346 cars. The railroads are buying in anticipation of better business with the late fall and early winter months. The effect has not yet been felt in the foundry industry, but will follow shortly.

Prices for Raw Materials for Foundry Use

CORRECTED TO SEPT. 24

Iron		Scrap	
No. 2 Foundry, Valley	$18.50 to 19.00	Heavy melting steel, Valley	$19.25 to 19.50
No. 2 Southern, Birmingham	17.50 to 18.00	Heavy melting steel, Pitts.	20.00
No. 2 Foundry, Chicago	20.50 to 21.00	Heavy melting steel, Chicago	16.50 to 17.00
No. 2 Foundry, Philadelphia	20.76 to 21.26	Stove plate, Chicago	17.50 to 18.00
No. 2 Foundry, Buffalo	19.00 to 19.50	No. 1 cast, Chicago	20.50 to 21.00
Basic, Valley	19.00 to 19.50	No. 1 cast, Philadelphia	18.00 to 19.00
Basic Buffalo	19.00 to 19.50	No. 1 cast, Birmingham	14.00 to 15.00
Malleable, Chicago	20.50 to 21.00	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.00 to 19.50	Car wheels, iron, Pittsburgh	19.50 to 20.00
Coke		Car wheels, iron, Chicago	18.50 to 19.00
Connellsville foundry, coke	$4.50 to 5.00	Railroad malleable, Chicago	18.25 to 19.00
Wise County foundry, coke	4.50 to 5.00	Agricultural mal., Chicago	17.50 to 18.00
		Malleable, Buffalo	18.00 to 18.50

Auto Outlook Improves

Brighter prospects are reported by manufacturers of automobiles. The department of commerce notes an increase of over 2½ per cent in August, when the total of passenger cars and trucks manufactured reached 269,115. July was the turning point of a four month period of declining sales and production, when the total of all classes of automobiles made was 262,903. Further, improvement in employment conditions is noted in all automobile manufacturing centers. Dealers are not stocking in advance of immediate needs, so that the present activity is taken as a direct reflection of consumer demand. The executive vice president of a large manufacturer of automobile engines reported recently that his August production scheduled was 1½ times that of August, 1923, while the September schedis twice that for the same month last year. It is thought that the year's total production will fall considerably short of the high output of 4,000,000 cars reached in 1923, but the fall months are expected to build up the years total. Automotive foundries are increasing their operating schedules, but still are below normal in many instances.

Steel Orders Still Low

According to the department of commerce, bookings of steel castings as reported by 70 identical companies dropped from 37.9 per cent in July to 36.1 per cent in August, continuing the steady decline since March. The greatest loss was registered by railway specialties, the July rate being given as 41.5 per cent and that for August as 37.2 per cent. Cast-iron pipe bookings continue practically to equal shipments, with a comfortable backlog of orders on hand. Some of the larger steel companies, feeling that prices are at a low point are buying needed machinery and this is serving to bring business to some of the large foundry establishments particularly in central Pennsylvania. Eastern jobbing foundries report improved orders. Stove foundries in Ohio, Indiana and Illinois are running slack, operating at from 55 to 70 per cent of capacity, but are looking forward to improved business in the fall. Buying of steel by agricultural implement manufacturers promises improved business in specialty foundries making this class of work. Building construction is slow, although a slight increase was noted in August. Residential and industrial construction is taking precedence over commercial buildings in the slight gain. Furnace and radiator business has been satisfactory throughout the summer and is expected to improve with the advance of the winter season. The prospects in malleable castings lines are improved, although the rate of operation, in general, is low. The betterment in railway and automotive lines is expected to bring more business to this particular branch of the castings industry. Sanitary ware shops continue at a fair standard of operation.

Brass Rate Varied

Jobbing brass foundries note improved demand within the past few weeks, while the specialty shops making bushings and bearings are expecting considerable increase in demand due to the betterment in railway car and automobile manufacturing conditions. Plumbing goods brass has been slow, during the summer, but is expected to improve, as jobbers stocks are low and the accelerated residence construction will be quickly reflected in castings demand. The rate of operation among plumbing goods shops probably is little better than 55 to 60 per cent. Prices on nonferrous metals based on New York quotations in the *Daily Metal Trade* of Sept. 24, follow: Casting copper, 12.75c; electrolytic copper, 13.00c; Straits tin, 46.37½c lead, 8.00c; antimony, 11.25c; nickel, 31.00c; aluminum, No. 12 alloy, remelt, 21.00c to 21.50c. Zinc is 6.12½c E. St. Louis, Ill.

Personal

Augustus Wood has been made works manager of the Putman Machine Works of Manning, Maxwell & Moore, Fitchburg, Mass.

E. G. Rippel, for many years associated with the Buffalo Foundry & Machine Co., has become connected with the Chemical & Vacuum Machinery Co., Inc., Buffalo, as president.

W. J. Weir, formerly connected with the West Steel Casting Co., Cleveland, has been made general foreman of the Springfield plant of the Ohio Steel Foundry Co., Lima and Springfield, O.

Howard Lester has joined the Marion Machine Works, Marion, O., which is building a foundry in connection with its machine shop. The company has purchased the equipment of the Ohio Mfg. Co., Upper Sandusky, O. It is expected that the foundry will be in operation by Oct. 15.

W. L. Kalbach, patternmaker, Philadelphia, addressed the Philadelphia Foundrymen's association Wednesday, Sept. 10, on "Wooden and Metal Pattern and Model Making." C. F. Hopkins, works manager of the Ajax Metal Co., Philadelphia, spoke on the "Economic Production of Gasoline."

J. W. Hughes now is connected with the Quality Foundry & Mfg. Co., Los, Angeles, in the capacity of vice president and superintendent. Mr. Hughes served his apprenticeship as a molder in the Pullman foundry. He had charge of the Central Iron Works Foundry, Quincy, Ill., for seven years and was general superintendent of the Bridgeford Co. Louisville, Ky., for five years. He also was with the Keystone Iron Works, Los Angeles, for five years.

Obituary

James H. White of the firm of Patrick White & Sons, Perth Amboy, N. J., died recently at his home in that city.

W. Ed. Baird, representative of the Robeson Process Co., New York, died at his home in Syracuse, N. Y., Sept. 6. For the past 25 years Mr. Baird has been engaged in selling foundry supplies. He began his career with the C. E. Mills Oil Co., Syracuse, was with the C. E. Mills Mfg. Co. for approximately ten years and was connected with the Robeson Process Co., at the time of his death.

Aaron Jacobs for 56 years secretary and treasurer of the American Foundry & Machine Co., Hamilton, O., died at his home in that city recently after a long illness. In 1900, in conjunction with A. Ballinger, he formed the American Foundry & Machine Co.

British Foundryman Dies

The British foundry industry has sustained a loss in the death of Robert Buchanan Aug. 27 at Birmingham, England. Mr. Buchanan was one of the founders of the British Foundrymen's association, now known as the Institute of British Foundrymen. He attended the historic meeting in Birmingham in 1904, and on the formation of the association

ROBERT BUCHANAN

became its first president. He also was the first president of the Birmingham branch. For many years he was foundry manager of W. & T. Avery, makers of scales and weighing machines. He afterward went into business for a time at Walsall as a partner in the firm of Chamberlain & Hill, and subsequently joined the firm of Hall & Pickles of Manchester as consulting expert in foundry matters. He gave many addresses and papers at foundrymen's and other meetings, showing a good all round knowledge of foundry matters. His last lecture was given this year at the Foundry exhibition at Birmingham. The funeral was attended by representatives of the Institute of British Foundrymen, the Staffordshire Iron & Steel Institute, the British Cast Iron Research association and other technical organizations. Mr. Buchanan was exceedingly popular with the foundrymen, not only of his own country, but with visitors from America.

H. W. Collart Is Dead

Houghton W. Collart, manager of the advertising copy and art service department of the Penton Publishing Co., Cleveland, died Sept. 18 at Lakewood hospital after several weeks' illness, aged 41 years. He had been in the service of the Penton company for 17 years and was widely known as one of the most successful advertising art service managers in the country. He was chairman of the committee which wrote the "Handbook for Business Paper Advertisers" for the Associated Business Papers, Inc., which is regarded as standard. Mr. Collart was widely known among foundrymen and those identified with the equipment and supply divisions of the industry. Through personal acquaintance with the technical and business branches he was exceptionally well informed on the mechanical phases of foundry practice.

Personally Mr. Collart was a most likable man, popular among his fellow employes and with a wide and discriminating advertising clientele because of his keenness of perception, sound judgment, progressiveness and fine sense of art values. He is survived by his widow and three children.

To Hold Exhibition

The Birmingham chamber of commerce, Birmingham, England, has decided again to organize an international foundry trades exhibition in 1926 upon the same lines as the two previous successful exhibitions held in 1922 and 1924.

Appoint Engineer

Percy M. Brotherhood now is consulting engineer with Manning, Maxwell & Moore, Inc., New York. Frank J. Baumis is vice president in charge of the machinery department of that company.

Use More Aluminum

That automotive manufacturers are continuing to use steadily increasing tonnage of aluminum is evidenced by the fact that consumption over a period over two years' time has more than doubled. Estimates for 1924 consumption in the manufacture of cars and trucks place the figure at approximately 87,000,000 pounds.

Morris Hobbs, formerly associated with Mills, Rhine, Bellman & Nordhoff, Toledo, and previously with Frank D. Chase, Inc., Chicago, has become a a member of the firm of Gerow, Conklin & Hobbs, Spitzer building, Toledo.

Tool Crib Saves Time in the Foundry

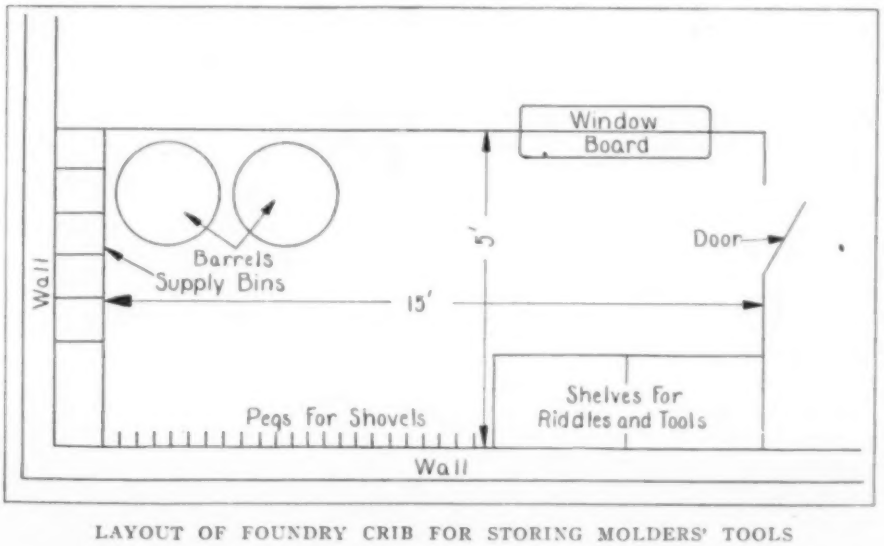
By J. P. Glynn

Molders' tools left lying around the foundry at the close of the day often become misplaced and scattered, or are used by the night gang who sometimes carry them to other parts of the shop. This necessitates a search in the morning and often a new tool must be issued before the molder may start work. However, with proper operation, a tool crib in the foundry not only enables the molder to get an early start in the morning, but conserves the supplies issued to and charged to the molding department. In one foundry where a crib was installed it was found that the department used approximately 30 per cent less tools and supplies in a given period than was used in a period of the same length before the crib was installed.

An economical arrangement for a foundry tool crib in which are stored molders tools, riddles, shovels and general supplies for the molding department, is shown in the accompanying illustration. The crib, which is placed in one corner of the department, has outer walls, 4 feet high built of sheeting placed on a wooden frame. A heavy wire net is spread over the framework from the top of the wall to the ceiling of the shop. This makes a substantial crib, one that is not easily broken into and one which will have plenty of light.

A large window is provided on the outer side through which all tools and supplies are issued. Shelves are arranged on the back wall opposite the window. These shelves are large enough to accommodate riddles. Smaller tools are placed on the inside of the riddles. The molders' shovels are hung on pegs along the back wall. Every peg is numbered to correspond with molders' clock number, this also being the number of the shovel and riddle. Shelves and bins are built against the end wall to accommodate various sizes of chaplets, special gates, etc. that may be used in the department. Supplies, such as plumbago, parting, etc., are kept in the crib and may be issued to the molder when needed. Keeping supplies in sufficient quantity in the crib eliminates numerous trips to and from the main stock room.

It is considered good practice to have someone take charge of the crib a few minutes before work time in the morning and issue the tools to the molders, and at quitting time to take the tools as they are returned to the crib and put them in the proper places.



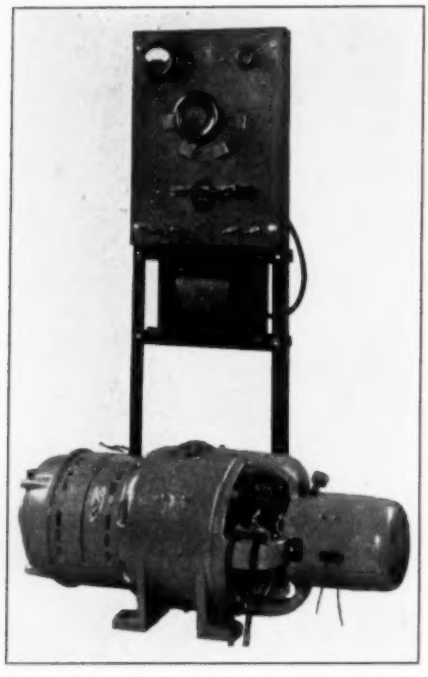
LAYOUT OF FOUNDRY CRIB FOR STORING MOLDERS' TOOLS

Sand Causes Majority of Foundry Troubles

Question: Sand burns on to the surface of our castings to such an extent that it is almost impossible to clean them properly and after they are machined the finished surface is disfigured with pin holes. Our cupola is lined to 36-inch diameter on the inside and is provided with six 3 x 5-inch tuyeres. We shall appreciate your opinion on whether our sand or our cupola practice is responsible for the condition of the castings. Where can we secure a sand that will strip clean from light and medium weight gray iron castings. What air pressure will insure the most satisfactory results? What is the difference between a positive pressure blower and the ordinary fan blower?

Answer: Taking your statements and questions in the order in which they are presented we are inclined to the opinion that your trouble with dirty and pin holed castings is due to your sand. Pin holes sometimes are caused by oxidized iron and present a possibility in your case on account of the comparatively small tuyere area of the cupola. You did not state whether or not you covered the surface of the molds with a protective coating, but we assume that you used one of the many forms of blacking available for the purpose. Some sands are more refractory than others, but molten iron will stick to them all if they are not protected in a suitable manner. Where the refractory content is sufficiently high the sand easily is removed from the surface of the castings in a tumbling mill or under the sandblast. Other sands, in which the bonding material is unusually high, present an almost impossible problem in the cleaning room. We suggest you get in touch with a reliable foundry supply house where the manager will be glad to advise you on the most suitable sand for your purpose. If you have a considerable quantity of sand on hand or if you are limited in your source of supply, you may *doctor* the sand by the addition of sharp sand. To obtain the best result a fine grain sand should be selected and the mixture should be prepared in a devise of the muller type where one or two heavy rollers revolve in a pan.

Your cupola tuyeres are too small to operate the cupola efficiently. A 36-inch cupola requires a 14-inch diameter main blast pipe and a fan capable of delivering 150,000 cubic feet of air per hour at 6 to 8-ounce pressure to melt its rated capacity of 5 tons per hour. A 14-inch blast pipe has a cross sectional area of about 150 square inches. Your combined area of six 3 x 5-inch tuyeres is only 90 inches. With your present arrangement you may be getting the proper pressure but you are not getting the volume. On the other hand if you are getting the volume, then assuredly your pressure is too high. A high blast pressure necessitates a high coke bed and even when watched carefully there is constant danger of oxidizing the iron and producing castings with pin holes. Ideal conditions are secured with ample volume and low pressure. A positive pressure blower delivers a definite uniform volume of air against various pressures. An ordinary blower of the fan type delivers a definite uniform volume of air so long as the opening is clear. If the tuyeres slowly close as they do in many cases during the progress of the heat, the pressure gage on a fan blower will register higher pressure. With a higher pressure one would be justified in assuming that a greater quantity of air was being delivered. In this case the contrary is true. The pressure may be in the main pipe while only a small quantity of air is being delivered to the cupola.



MOTOR DRIVEN WELDING GENERATOR IS SEPARATELY EXCITED

BuildsWeldingGenerator

The Allen Mfg. & Welding Co., Inc., Buffalo, has introduced a motor driven, 120 cycle welding generator in connection with its line of welding transformers. The generator is separately excited, having eight poles for 1800 revolutions per minute and 10 poles for 1500 revolutions per minute. The frame is cast steel with laminated pole pieces. Each pole is provided with but one coil, while all coils on pole pieces are connected in series. The armature is built up on a large diameter shaft and is carried on two ball bearings, while an extension of the shaft carries the exciter armature, the frame of which is cast integral with one end bell. The exciter is eliminated where the power supply is direct current. The generator may be driven by belt and is built in any desired capacity to satisfactorily comply with individual requirements.

Refine Metal Direct in Electric Furnace

By James Thomas

Direct metal has been used to great advantage in producing certain kinds of castings such as ingot molds, stools, etc. Kish, which is found in more or less quantities, has no derogatory effect on such castings, but tends to improve the product, and makes castings more serviceable. It has been shown that direct metal castings withstand the effects of heat and cold with the corresponding expansion ,and contraction in a greater degree than castings made from the more refined cupola and air furnace iron.

Foundries using only direct metal are restricted in the class of work they can handle owing to the direct iron being coarse grained and carrying more or less kish. The use of the electric furnace in refining this direct metal would enable such a foundry to produce a regular line of castings and comply with the most rigid chemical and physical specifications.

The direct metal from the blast furnace could be charged in the molten state into the electric furnace of suitable capacity, and brought up to the correct temperature to refine the metal by removing the kish and any excess in the metalloids by oxidation or additions may be made in the form of ferrosilicon, ferromanganese, etc., if the iron is too low in these elements. The charging and operation of the electric furnace could be worked in conformity with the operation of the blast furnace.

Up to the present the refining of the direct metal by the use of the electric furnace has not been tried, but the writer considers there are great possibilities along these lines to aid production and lower costs.

Improvised Dowel Pins

Common wood screws and pieces of brass tubing may be employed as dowel pins under certain circumstances. The screw heads are ground off and slightly tapered as shown in the accompanying illustration, but the slots are not removed. The screw may be inserted securely into the pattern and in thin strips like that shown, actually adds to its strength. The wood screw dowel may be easily and quickly either inserted or removed and will not readily shift or work loose. The screws are taken from the ordinary stock and the pieces of brass bushing usually are available in the scrap pile.

To Operate Plant

The Eagle Iron & Brass Foundry, Passaic, N. J., which recently purchased the Gillespie Foundry Co., Paterson, N. J., will operate both plants under the name William P. Laythem & Sons Co.

Appointed Distributor

The George M. Kenyon Co., Zenith building St. Paul, has been appointed distributor for the Hanna Engineering Works, Chicago, in Minnesota, North Dakota, South Dakota, Iowa, and the eastern part of Nebraska.

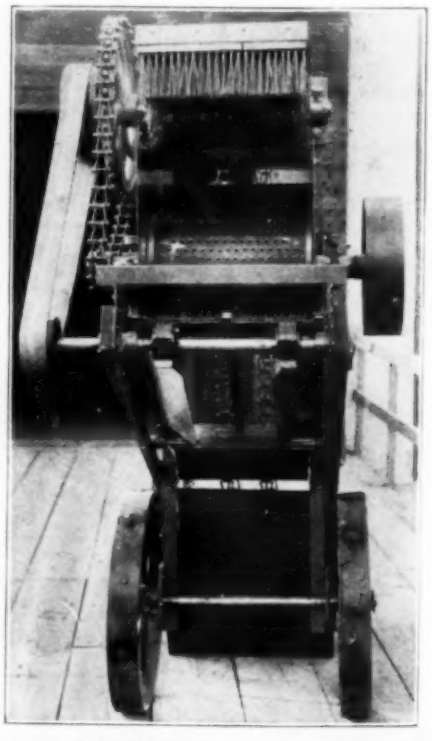
Machine Revivifies Sand

A sand disintegrating and screening machine recently has been developed by the Newaygo Engineering Co., Newaygo. Mich. This machine is built in both the portable and stationary types, both types of machines being furnished in several sizes. The accompanying illustration shows the medium size portable machine, the mechanism for disintegrating and screening being clearly illustrated.

The foundry sand is fed into a shaking hopper from which it is passed to a steel cylinder, on which hardened steel pins are mounted. The sand is carried by the cylinder, which revolves at high speed, through a steel brush which works against the cylinder. Clay balls are broken up and the sand is areated by being worked by the revolving cylinder and in passing through the steel brush. The sand then drops upon a bumping screen where oversize and foreign material is separated from the sand. A screen on the feed hooper also removes any large pieces of tramp iron, etc. The mesh of the screen may be furnished to suit the conditions existing in the particular foundry.

The distribution of this line of machines in the United States and Canada is being handled by the National Engineering Co., Chicago.

The Hill & Griffith Co., Cincinnati, has awarded a contract for a Chicago branch plant warehouse to the Austin Co., Cleveland.



THE SAND SCREENING AND AERATING MACHINE IS BUILT IN PORTABLE OR STATIONARY TYPE

Equipment Demand Is Spotty

Manufacturers in Several Centers Report a Slackening in Demand During the Past Two Weeks—Expect Increase in Buying After Coming Exhibition—Exports of Equipment Decline

DEMAND for foundry equipment through the country appears to be rather spotty, the majority of distributing centers reporting a falling off in the volume of business closed during the past two weeks when compared with the previous two week period. However, this is considered a temporary condition, since the general trend of foundry operations is upward, and it generally is expected that the slackened condition shortly will be relieved. Manufacturers feel that the outlook for the remainder of the year is indeed encouraging and believe that considerable impetus will be given sales by the exhibitions to be held. The Beardsley & Piper Co., Chicago, has sold a number of sand throwing machines of various types. Sales of sand-blast equipment, sand mixing machines and molding machines also are reported.

Exports of molding machines and other foundry equipment for July, as reported by the United States department of commerce, bureau of foreign and domestic commerce, totaled $49,099 as compared with $63,031 in June and $66,368 in May.

Manufacturers Feel Outlook Is Better

SALES of foundry equipment in the Pittsburgh territory have been fewer in number during the past two or three weeks although interest among foundry operators in their equipment needs appears to be at a high point. This is based upon inquiries being received and others being revived. Tumbling mill manufacturers report that numerous propositions are pending in each of which one to five machines will be bought. Several machines are on the floor ready for shipment, merely awaiting confirming orders to follow up verbal or telephone orders placed recently. The Canadian Westinghouse Co., Hamilton, Ont., was a recent buyer of two large rollover machines from the Herman Pneumatic Machine Co., Zelienople, Pa. The Iron City Sanitary Mfg Co., Zelienople, recently purchased a cupola blower from a Pittsburgh dealer. A western Pennsylvania manufacturer is in the market for complete equipment for a small foundry it is about to install, and another pending inquiry here calls for a used 72-inch cupola. The Pressed Steel Car Co., Pittsburgh, bought several core ovens from the Swartwout Co., Cleveland. Among sales reported by the J. S. McCormick Co., Pittsburgh, is that of an electric sand riddle to a foundry at Salem, O., a dump bucket to a Hamilton, O. user; a ladle, bowls, as well as cupola charging cans, the latter in lots of 500 or 600 at a time, to various foundries scattered throughout the district. The Standard Sanitary Mfg. Co., New Brighton, Pa., has purchased sand blast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. A recent feature in the crane market is the award by the Westinghouse Airbrake Co. of cranes and hoists for its new brass foundry at Wilmerding, Pa. This went to the Shaw Electric Crane Works, Muskegon, Mich., and comprised six 3-ton wall cranes, two 5-ton overhead cranes with 51-foot, 1½-inch span, one each 5-ton with 37-foot span, 5-ton with 33-foot span, and 3-ton with 33-foot span, and one monorail hoist.

Expect Increased Demand

MANUFACTURERS of foundry equipment in the Chicago district note slightly increasing resistance to closing business in the past two weeks, but inquiries for future consideration are displaying no diminution. Sand mixers made by the National Engineering Co., Chicago, have been placed in the foundries of the Covel Mfg. Co., Benton Harbor, Mich., Ohio Brass Co., Mansfield, O., and the Hershey Foundry & Machine Co., Lancaster, Pa. The Beardsley & Piper Co., Chicago, has sold tractor type sand throwing machines to the Western Foundry Co., Chicago, the United States Cast Iron Pipe & Foundry Co., Scottdale, Pa., the Cleveland Co-operative Stove Co., Cleveland, Metters Ltd., Sidney, Australia, and the Fremont Foundry Co., Fremont, O.; the portable type to the Bessemer Foundry & Machine Co., Bessemer, Ala., the United States Cast Iron Pipe & Foundry Co., Bessemer, Ala., the Illinois Steel Co., South Chicago, Ill., the Dodge Mfg. Co., Mishawaka, Ind., a locomotive type to the Allis-Chalmers Mfg. Co., Milwaukee. The General Electric Co., Erie, Pa., has closed on a sandcutter from the same builder. The Detroit Stove Works, Detroit, has purchased tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland, and the Pullman Car & Mfg. Co., Chicago, has purchased dust arrester equipment from the same manufacturer. The Clinton Lock Co., Clinton, Ia., and the Holley-Carburetor Co., Detroit, have purchased sand-blast equipment from the Pangborn Corp., Hagerstown, Md.

Eastern Market Lags

THE improvement noted in the first part of September in the eastern foundry equipment market has disappeared. While sellers state that business is better than six weeks or so ago, the increase is so slight as to be almost negligible. Foundries supplying machine tool builders and textile machinery manufacturers are running at a low rate. Jobbing foundries seem to show a slight improvement, but not enough to stimulate much interest in new equipment. Such sales, as have been made recently, are largely for replacement purposes. A northern New Jersey plant has closed on a cupola with the Whiting Corp., Harvey, Ill. Included in prospective buyers are the Topton Foundry Co., Topton, Pa., planning an addition to its enameling department; and the Union Smelting & Refining Co., which has just placed a general contract for a $100,000 foundry unit at its plant in Newark, N. J. This concern is a subsidiary of the Federated Metals Co., New York. The Grupp Foundry Co., Quakertown, Pa., is reported to be planning the erection of a foundry. A lot of 350 tons of steel has just been placed by the Eastern Malleable Iron Co. for an extension to its plant at New Britain, Conn. The American Locomotive Co., Richmond, Va. and the Wilmington Malleable Iron Works, Wilmington, Del., a subsidiary of the Eastern Malleable Iron Co., have purchased sand-

blast equipment from the Pangborn Corp., Hagerstown, Md.

Betterment Is Maintained

DEMAND for foundry equipment in New England shows some increase especially from manufacturers of special equipment. Yale & Towne Mfg. Co. at Stamford, Conn., are in the market for four or five molding machines and other equipment including steel flasks. Gilbert & Barker Mfg. Co., Springfield, Mass., are increasing operations and are in the market for considerable foundry machinery. The General Electric Co., Lynn, Mass., has bought six molding machines and is asking for quotations on sand slinging equipment. Production at jobbing foundries is still at a low point and recent sales have been almost negligible to this class of consumer. The H. B. Smith Co., Westfield, Mass., has purcured dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland, and the Norton Co., Worcester, Mass., has secured dust arrester equipment from the same manufacturers. The S. M. Howes Co., Boston, Mass., has installed sandblast equipment made by the Pangborn Corp., Hagerstown, Md.

Sales Fall Slightly

THE general improvement in sales noted in the foundry equipment market in the Cleveland territory has not been maintained during the past few weeks. Several plants reporting orders coming in at a good rate two weeks ago now state that the market again has slackened. However, one or two builders of equipment report that business has improved steadily during the past month and that present sales are approaching a satisfactory condition. While buying has not been so marked, inquiries are keeping up at a good rate. Most dealers feel that the outlook for the remainder of the year is encouraging and are expecting buying to be stimulated by the exhibitions to be held in connection with the coming conventions The Singer Mfg. Co., New York, has purchased a tilted blast mill complete with dust arrester support and fan from the W. W. Sly Mfg. Co., Cleveland, for export to Glasgow, Scotland. The Grabler Mfg. Co., Cleveland, has purchased a blast pressure tank to complete a blast mill unit of the positive pressure type from the same manufacturer. The Buckeye Steel Castings Co., Columbus, O., has purchased six sand blast rooms from the Sly company instead of one as previously reported. The Ferro Machine & Foundry Co., Cleveland, has purchased a large oil fired casting annealing furnace for annealing castings that are to be welded and a continuous type electric drying oven for drying pasted and blackened cores from the F. A. Coleman Co., Cleveland. The Georgia Wool Stock Co., Atlanta, Ga., has secured a core baking oven and the Modern Foundry Co., Cincinnati, O. has purchased four rack ovens from the F. A. Coleman Co. A user is figuring on several sand mixing machines.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Groupp Foundry Co., Quakertown, Pa., plans erecting a plant addition.

Hilton Brass Foundry, Hilton, N. J., is increasing its plant capacity and is inquiring for some miscellaneous equipment.

Reed Roller Bit Co., 3602 Harrisburg boulevard, Houston, Tex., will construct an addition to its foundry and machine shops involing an expenditure of approximately $100,000.

The Golden Foundry Co., Columbus, Ind., has been formed with $35,000 capital, to own and operate a foundry, by Walter I. Golden, S. E. Smith and Charles Shipman.

J. W. Pohlman Foundry Co., 205 Baitz street, Buffalo, N. Y., plans constructing a 1-story foundry addition for the manufacture of light iron and steel castings.

The Harris-Thomas Drop Forge Co., Dayton, O., has been incorporated with $40,000 capital, by G. Ernest Harris, Laura M. Harris, S. Foster Harris, Charles H. and Grace Thomas.

Allis-Chalmers Mfg. Co., Milwaukee, is completing a pattern storage building, 7-story, 120 x 140 feet, costing about $200,000. The company operates gray iron, malleable and aluminum foundries.

The Olney Foundry Co., Duncannon and Mascher streets, Philadelphia, operator of a gray iron foundry, and subsidiary of the Link-Belt Co., Chicago, plans contructing a $25,000 plant addition.

Potter Radiator Corp., 5946 Pasadena avenue, San Diego, Cal., plans constructing plant to cost approximately $100,000 for the manufacture of radiators and other heating equipment.

South & Winchester Mfg. Co., South Windham, Conn., will construct a 1-story addition to its foundry, 48 x 90 feet. The company operates gray iron, brass and aluminum foundries.

The Oakley Bass Foundry Co., Oakley, O., has been chartered with $10,000 capital, to own and operate a foundry and machine shop, by C. M. Meyer, D. C. Ashton, H. D. Israel, William B. Israel and A. W. Schulman.

The Meeker Union Foundry Corp., Norwalk, Conn., recently bought in at auction the foundry of the Arnold Co., Hoyt street, that city. Both companies operated gray iron foundries.

The Eagle Iron & Brass Foundry, Passaic, N. J., which recently purchased the Gillespie Foundry Co., Paterson, N. J., will operate both plants under the name of William P. Laythem & Sons Co.

The Erie Howitzer plant, formerly the American Brake Shoe & Foundry Co. plant at 1305 West Twelfth street, Erie, Pa., is being sold at public auction by the war department.

O. J. Shafer Pattern Works, Inc., Cincinnati, has been formed with $25,000 capitalization, to manufacture and deal in wood and metal patterns, by Oscar J. Arthur C., Robert W., Emma M. and Oscar L. Shafer.

George J. Meyer Mfg. Co., 576 Clinton street, Milwaukee, has awarded contracts to C. B. Danielson, 185 Thirty-fifth street, that city, for constructing a brass foundry, 50 x 55 feet. The Meyer company manufactures machinery for brewing and bottling.

Jewell Steel & Malleable Co., 1375 Potrero avenue, San Francisco, manufacturer of steel and malleable castings, has purchased equipment for its plant extension being made. Sand blast, tumbling mills, air compressors, and motors were among the items purchased.

The American Foundry Co., Hot Springs, Ark., recently incorporated with W. F. Fullington as president and T. M. Fullingto as vice president, now is manufacturing sanitary fittings and contracting castings of iron and brass. *Noted Sept.* 15.

Tulsa Brass & Aluminum Castings Co., Tulsa, Okla., has completed an addition to its foundry doubling the capacity of the plant which now has a daily capacity of 1000 pounds or brass and aluminum castings. O. E. French is president and general manager.

The Reliable Pattern & Casting Co., Cincinnati, has been incorporated with $20,000 capital, to manufacture and deal in castings and patterns, by Elmer A. Young, Edward Korten, Carl Young, Arthur Kuhn and John Young, Jr.

Houston Oil Co., Camden, Ark., is constructing a large foundry and machine shop in connection with its oil refinery now being built. A. W. Standing, Senalon building, Houston, Tex., is general manager of the company.

Independent Foundry Supply Co., First and Spruce streets, St. Louis, will not construct any buildings or purchase equipment at present, but will manufacture and sell foundry supplies, etc. M. A. Bell, 4746 Greer avenue, is president of the company which recently was incorporated. *Noted Sept.* 15.

Power Mfg. Co., 913 Cheney street, Marion, O., has been incorporated in Dallas, Tex., to do business in that state. The company manufactures oil engines and operates a gray iron foundry. Erection of plants is contemplated in Texas. B. P. Moore is state manager of the Power company in Texas with headquarters at Dallas.

Bates Machine & Tractor Co., Joliet, Ill., was sold at public auction Sept. 18, by Oscar R. Laraway, 400 Heggie building, that city, referee in bankruptcy. Included in the assets liquidated were a fully equipped modern machine shop, power plant, and foundry. Miscellaneous machine tools, patterns and equipment also were auctioned.